2009

Maryland Energy Outlook

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Maryland Energy ADMINISTRATION

Powering Maryland's Future

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1.0 Executive Summary

The *Maryland Energy Outlook* (MEO) is a proactive "state of the State" review of Maryland energy issues and a look forward at potential further steps the State can take to meet our energy objectives in the years ahead. The State's energy programs support three key policy goals – affordable, reliable, and clean energy for Maryland's consumers.

Maryland, like many states, is on the cusp of an energy transformation. We are faced with a number of significant energy challenges, including increased globalization of the marketplace, the seemingly insatiable power demands of digital appliances and equipment, ever growing dependence on imported gasoline; and the need to significantly reduce greenhouse gas emissions. Rising to meet these challenges, Governor O'Malley and the Maryland General Assembly have enacted forward-looking energy goals and policies to reduce electricity consumption, level peak demand, and improve the market for renewable energy in Maryland.

Achieving these ambitious goals requires a long-term commitment to eliminate persistent market barriers and effect lasting marketplace transformation. Accordingly, the Maryland Energy Administration (MEA) has prepared this *Maryland Energy Outlook* to benchmark our progress to date and evaluate additional policy options to further:

- Reduce energy consumption,
- Improve the market for renewable energy,
- Reduce greenhouse gas (GHG) emissions,
- Grow a green economy with a robust workforce, and
- Promote energy independence through alternative transportation policies and use of alternative fuels for vehicles

To assist in the development of this report, MEA assembled a broad group of energy experts and stakeholders from across Maryland. Members of this ad hoc Advisory Group, listed in Appendix A, provided valuable assistance in assembling this report. The report and its recommendations, however, reflect the opinion of the Maryland Energy Administration and may not represent the views of any particular member of the Advisory Group.

1.1 Maryland's Energy Goals

Governor O'Malley and the General Assembly have established a set of ambitious energy goals for Maryland, including:

Energy Reduction

The EmPOWER Maryland Energy Efficiency Act of 2008 sets a target of 15% reduction in per capita electricity consumption and a 15% reduction target in peak demand by the end of 2015 based on a 2007 baseline.

Renewable Energy

Maryland's Renewable Portfolio Standard (RPS) requires that 20% of Maryland's electricity be generated by renewable sources by 2022, including 2% from solar.

Climate Action

The Greenhouse Gas Reduction Act of 2009 requires Maryland to reduce GHG emissions 25% compared with 2006 levels by 2020.

Green Jobs

In 2009, Governor O'Malley announced his Smart, Green, and Growing legislative agenda, which set a target to create 100,000 green jobs in Maryland by 2015.

1.2 What Actions Have Been Taken and What Are the Results So Far?

EmPOWER Maryland

Maryland has made remarkable progress towards achieving the peak demand reduction goals set by EmPOWER Maryland. Utilities have committed to reduce peak demand by 1,933 MW in 2011, and 2,850 MW in 2015.[1] If these peak demand reductions materialize, they will, in fact, surpass the EmPOWER Maryland goals.

Maryland has also made significant progress towards achieving the EmPOWER Maryland energy efficiency goal. According to the American Council for an Energy Efficient Economy, Maryland's overall state ranking on energy efficiency has risen in just the last three years from 20th in the nation in 2006 to 11th in 2009.[2] Utilities have received regulatory approval to implement a variety of programs and consumer incentives, such as essentially free home energy audits, up to $1,300 for implementing recommended measures, and rebates for purchasing energy efficient appliances. These programs are estimated to reduce statewide electricity consumption by approximately 4,670 GWh by 2015, which is equivalent to avoiding the need to build a large 600 MW coal plant. Nevertheless, there is still much work to be done, as we are less than half way to our overall 15% EmPOWER Maryland reduction goal of approximately 11,200 GWh.[3]

In addition to the utility energy efficiency and demand response programs and the new initiatives funded through the SEIF and ARRA, Maryland is working on several other fronts to push for increased energy efficiency. The State's building energy codes have been strengthened through adoption of the 2009 International Energy Conservation Code (IECC). Maryland also continues to adopt and enforce efficiency standards for appliances not covered by federal standards, and the State is working to promote efficient combined heat and power (CHP) systems. The proposed deployment of advanced meters and smart grid technology also promise to make a significant contribution to achieving the EmPOWER Maryland goal.

[1] Maryland PSC, *BGE EmPOWER MD Staff Initial Comments*, Tables ES1a-ES1b; EmPOWER Maryland Targets and Population established by the PSC.
[2] American Council for an Energy Efficient Economy, *2009 State Energy Efficiency Scorecard*, at http://aceee.org/pubs/e097.htm and the 2006 State Energy Efficiency Scorecard, p. iv
[3] Maryland PSC, *BGE EmPOWER MD Staff Initial Comments*; EmPOWER Maryland Targets and Population established by the PSC.

Renewable Portfolio Standard

Maryland is only beginning to show progress in fulfilling the State's RPS mandate.[4] Maryland's RPS obligations are satisfied through submission of Tier 1 and Tier 2 Renewable Energy Credits (RECs). Maryland-based renewable generation was the source of approximately 16% of the overall RECs used for compliance in 2007, with the rest being generated out of state. Companies can also comply by paying an alternative compliance payment, which generated over $1 million in 2008 (mostly to comply with the solar carve-out provisions).

The slow progress is not surprising, however, as the changes enacted in 2008 to enhance REC prices, namely the increase in RPS obligation and the narrowing of the eligible territory to exclude projects outside of the PJM footprint, do not go into effect until 2011. Nevertheless, if Maryland is to meet a significant portion of its RPS requirement through in-state generation, new commercial scale renewable sources, including solar, land-based and offshore wind, must be developed.

Maryland is working actively to promote renewable energy generation within the State. Grants to residential consumers for solar, wind, and geothermal heat pumps have soared from a few hundred last year to over a thousand expected to be awarded in fiscal year 2010. The Clean Energy Production Tax Credit offers a state income tax credit for electricity generated from qualified renewable sources. The State and the University of Maryland have issued a joint RFP in an effort to jumpstart commercial scale renewable energy production by offering a long-term power purchase agreement. The State has also launched a technical study in 2009 of the potential of offshore wind and released a Request for Expressions of Interest and Information from wind energy developers interested in developing wind energy generation facilities in Maryland's offshore waters. Maryland also spearheaded a Mid-Atlantic Off-Shore Wind Memorandum of Understanding with Virginia and Delaware to work collaboratively to develop our shared coastal resources.

Climate Action

The recently enacted Greenhouse Gas Reduction Act of 2009 requires Maryland to reduce GHG emissions 25% compared with 2006 levels by 2020. Most of the actions taken by the State so far to implement this Act are too early in their planning and implementation process to realistically analyze effectiveness. However, the Maryland Climate Action Plan, published in 2008, lays out an extensive set of 42 policy options that are currently being assessed. In addition, the Regional Greenhouse Gas Initiative (RGGI), in which Maryland is a participant, has proven highly successful. While legislators in Washington DC continue to debate a national climate solution, the RGGI states are implementing a market-based mechanism that established a price for carbon emissions (most recently, $2.08 per ton). Not only does this encourage investments in less carbon intensive technologies, the five auctions held since September 2008 have generated $84.8 million for the State, a significant portion of which is being spent on projects to reduce climate change-causing emissions.

Green Jobs

The Governor's Workforce Investment Board (GWIB) estimates that Maryland's green economy includes roughly 22,000 businesses directly employing nearly 250,000 people and generating total

[4] Maryland's RPS law encompasses tier 1 resources including solar, wind, certain biomass, landfill methane, geothermal, ocean, fuel cell, small hydropower, and poultry litter, and tier 2 resources including hydroelectric (larger than 30 MW) and waste-to-energy.

wages of $14.6 billion, [5] including Baltimore based DAP, Frederick based BP Solar, and Beltsville based Sun Edison.

To expand and attract more clean energy businesses, Governor O'Malley and the General Assembly created the Maryland Clean Energy Center, launched in January 2009, to focus on clean energy economic development. The State also has begun to offer educational and training programs at four year colleges, universities, and community colleges that will result in a trained workforce for a green economy. Finally, MEA is partnering with the Clean Energy Center and DBED, using federal stimulus funding, to establish the Clean Energy Economic Development Initiative (CEEDI) program to provide funding for clean, green energy businesses and organizations.

1.3 What More Can Maryland Do?

Maryland has deployed aggressive programs to address its energy challenges and meet its energy goals. Nevertheless, more will be required to create a truly clean, affordable, and reliable energy marketplace for Maryland's citizens. This *Maryland Energy Outlook* begins that task by investigating key options that could be effective in helping the State meet its goals. These options have been analyzed for their current level of deployment in Maryland and their success in other states. Both the costs and potential benefits of each option are presented.

A number of options in the *Outlook* address efforts to increase energy efficiency. Others relate to increasing renewable energy capacity. Additional options are designed to improve Maryland's clean energy economy, as well as its transportation infrastructure and use of alternative fuels for cars and buses. The options discussed in this *Outlook* are listed below:

Energy Efficiency and Conservation

- Implement time-of-sale disclosure of energy performance for residential and commercial buildings
- Offer tax credits for zero energy and zero energy ready buildings
- Design and implement combined heat and power (CHP) initiatives
- Promote the Commuter Connections alternative transportation program

Increased Use of Renewable Energy

- Modify the solar RPS "carve-out" by accelerating the phase-in of the solar RPS requirement and adjusting the Alternative Compliance Payment (ACP) penalty
- Extend the waste-to-energy RPS requirement
- Establish a "carve-out" for ocean energy in the RPS
- Extend and expand Maryland's Renewable Energy Production Tax Credit program
- Increase the availability and use of biodiesel and high-level ethanol blends
- Promote electric drive vehicles
- Lead-by-example to "green" the State fleet of vehicles

[5] Maryland Governor's Workforce Investment Board. *Maryland's Energy Industry Workforce Report: Preparing Today's Workers for Tomorrow's Opportunities*. September 2009, http://www.mdworkforce.com/pub/pdf/energyworkforce.pdf

Clean Energy Economic Development

- Create a multi-billion dollar, multi-year fund for clean energy manufacturing facilities and workforce development

1.4 Recommendations

2.0 Maryland's Energy Landscape and Goals

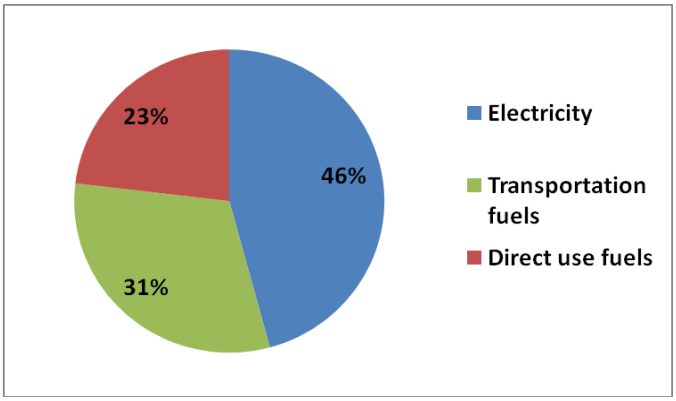
The State of Maryland seeks affordable, reliable, and clean energy to fuel our future prosperity. While we face a number of serious challenges, legislation enacted by Governor O'Malley and the General Assembly over the last three years have created ambitious energy-related goals that chart a path towards a more sustainable and greener future. These goals have established Maryland as a national energy leader.

Setting a goal, however, is not the same thing as achieving it. This chapter focuses on Maryland's energy landscape, the State's adopted energy goals, and identifies steps already taken towards achieving them. It also looks at the preliminary results to gauge our progress to date. Following chapters will build on this data to evaluate what more we can do to accelerate our progress to improve the lives of all our citizens, expand the State economy, and improve the region's natural environment.

2.1 Maryland Energy Landscape

Maryland consumers use energy for all of their daily activities. According to the latest data from the U.S. Department of Energy (DOE), overall energy demand in Maryland totaled 1,489 trillion Btu in 2007, or approximately 1.5% of all energy demand in the United States.[6] Exhibit 2.1 shows consumption by energy type in Maryland across all end-use sectors – residential, commercial, industrial, institutional, and transportation. Electricity consumption accounts for nearly half, or 46%, of all energy used in the State.

Exhibit 2.1: Maryland Energy Consumption - Electricity, Transportation & Direct Use Fuels*

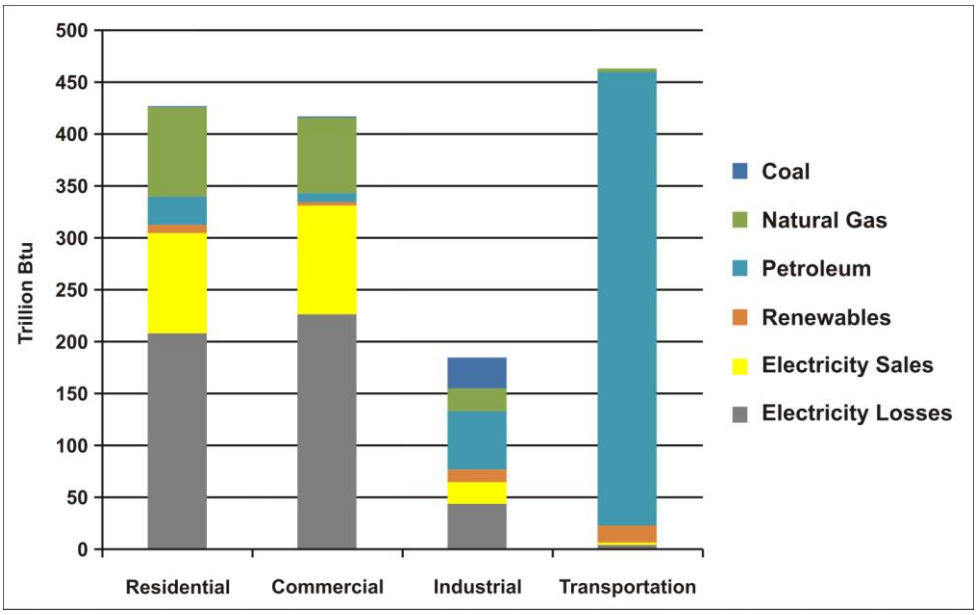


Source: EIA, *State Energy Data 2007: Consumption*
* Direct use fuels are fuels other than electricity that are used directly in homes and businesses, such as natural gas, propane, and heating oil.

Maryland's energy use by economic sector and fuel is portrayed in Exhibit 2.2. The transportation sector is the major consumer in Maryland, using 31% of total energy. The industrial sector consumes approximately 12% of total energy, with the residential and commercial sectors using 29% and 28% respectively. Note that electricity losses, losses during the generation, transmission and distribution of electricity, are 31 % of overall energy consumption,[7] which highlights that small improvements in efficiency could make a significant difference.

[6] U.S. Department of Energy (DOE), Energy Information Administration (EIA), *State Energy Data 2007: Consumption* (latest data available)
[7] EIA, *State Energy Data 2007: Consumption, Maryland*

Exhibit 2.2: Maryland Energy Consumption by Sector and Fuel



Source: EIA, *State Energy Data 2007: Consumption*

Maryland's Energy Supply Infrastructure

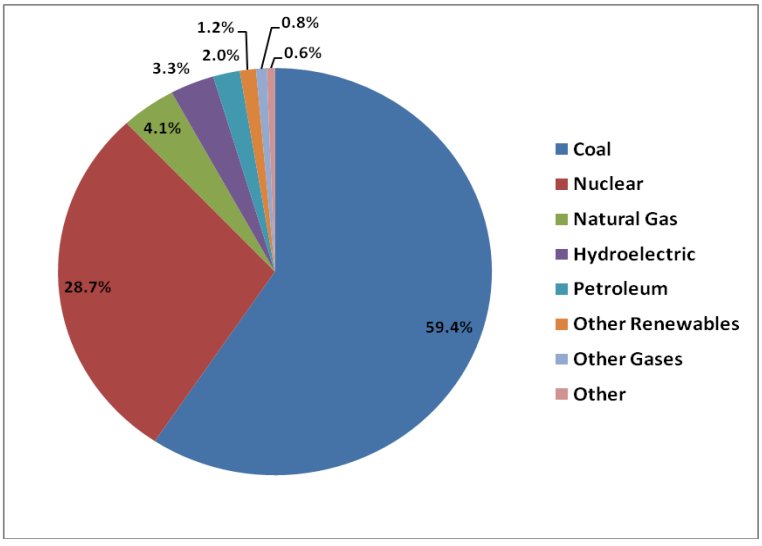
Lacking indigenous fossil fuel resources, Maryland currently relies on imported energy sources for most of its energy needs.

All petroleum and natural gas products are transported to Maryland via pipeline or through other entry points, such as the Port of Baltimore or Maryland's liquefied natural gas (LNG) facility, Cove Point, on the Chesapeake Bay's western shore.

Maryland imports approximately 30% of its electrical energy from surrounding states.[8] The State is part of the Pennsylvania-New Jersey-Maryland (PJM) Interconnection, or power grid. PJM encompasses 13 states and the District of Columbia, and its installed capacity of 163,000 MW serves more than 50 million people.

Maryland imports coal to generate electricity in state. As evident in Exhibit 2.3, nearly 60% of electricity generated in Maryland is coal-fired. Coal-fired power plants contribute

Exhibit 2.3: Electricity Generated (MWhs) in Maryland (2007)



Source: Maryland PSC, *Ten-Year Plan (2008-2017) of Electric Companies in Maryland*

[8] EIA, *State Electricity Profiles 2007, Maryland*, http://www.eia.doe.gov/cneaf/electricity/st_profiles/maryland.pdf

approximately 5,000 MW to in-state summer peak capacity. Maryland also operates two nuclear power plants at Calvert Cliffs, which provide 1,735 MW of capacity and generate approximately 29% of electricity produced in Maryland. On the other hand, hydroelectric plants and other renewable sources contribute roughly 700 MW of capacity and approximately 3% of in-state generation.[9]

To reduce electricity congestion and increase capacity, a number of new transmission projects are being proposed, three of which would impact Maryland: the Trans Atlantic Interstate Line (TrAIL), the Potomac-Appalachian Transmission Highline (PATH), and the Mid-Atlantic Power Pathway (MAPP). The Mid-Atlantic region has been designated as a National Interest Electric Transmission Corridor (NIETC). This designation means that additional transmission capacity is so critical that the Federal Energy Regulatory Commission (FERC), under limited conditions, may issue permits for regional transmission line projects that are deemed to be in the national interest.

Energy Prices in Maryland

Residential, commercial, and industrial customers are all impacted by energy prices, which are in-turn driven by many different factors. Availability of supply, electricity markets, economic downturns, transport issues, financial market speculations, and a myriad of other factors impact the price of energy.

Maryland consumers have faced high energy prices in recent years. According to the U.S. Department of Energy, as of July 2009, Maryland's residential electricity price averaged 15.95 cents per kWh. This places Maryland as the 8th highest in the nation, below New York and New Jersey and slightly higher than Delaware and the District of Columbia. By contrast, the national average in July 2009 was 11.96 cents per kWh, about 25% less.[10]

Maryland also ranks 12th in the nation in the price of residential natural gas. Natural gas - used primarily for heating purposes - costs Maryland consumers more than $20/thousand cubic feet, as compared to the national average of less than $15 dollars/thousand cubic feet.[11]

What Drives Energy Supply, Demand, and Prices in Maryland?

Energy demand is a result of a number of drivers, including population growth. In Maryland, population is expected to grow 12.5 % between 2008 and 2020.[12] This is due, in part, to the completion of the Base Realignment and Closure (BRAC) process, which will add thousands of workers and their families to the State in the coming years. New electrical capacity and new transmission and distribution infrastructure will be needed to meet the needs of our new residents.

Historically, economic growth rates have had a significant effect on the rate of growth for energy demand. Periods of strong economic growth have been accompanied by robust growth in energy demand, and times of slower economic growth have meant less rapid growth in energy consumption.

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[9] Maryland PSC, *Ten-Year Plan (2008-2017) of Electric Companies in Maryland*
[10] EIA, *State Rankings, Electricity Residential Prices, July 2009*, http://tonto.eia.doe.gov/state/state_energy_rankings.cfm
[11] EIA, *State Rankings, Natural Gas Residential Prices, August 2009*, http://tonto.eia.doe.gov/state/state_energy_rankings.cfm
[12] Maryland Department of Planning, *Historical and Projected Total Population for Maryland's Jurisdictions,* December 2008, http://www.mdp.state.md.us/msdc/popproj/TOTPOP_PROJ08.pdf

Over the last few years, transmission congestion and constraints in the PJM region have put upward pressure on electricity prices and caused concern about the reliability of the electricity delivery system in Maryland. However, the success of the EmPOWER Maryland program in prompting effective peak demand reduction strategies, combined with the effects of the current economic recession and Maryland PSC's "gap RFP" proceedings[13], have delayed the threat of significant capacity deficits and the potential for rolling "brownouts" for several years.[14]

A significant factor that affects Maryland consumers are global and national energy prices for primary sources of energy. For example, oil prices are determined on the global markets. Prices of natural gas and coal are also affected by international developments, but domestic supply and demand balance plays a significant role in determining market prices.

Addressing the threat of global climate change is a significant driver of energy policies at all levels of government. Even though the U.S. federal government has yet to enact legislation to curb greenhouse gas emissions, international negotiations are underway to enhance the existing framework for reducing emissions. Efforts to reduce more localized criteria pollutants are also an important impetus for striving towards new, cleaner energy resources.

2.2 What Are Maryland Energy Goals?

EmPOWER Maryland

Recognizing that the cheapest kilowatt is the one not needed, Governor O'Malley championed the *EmPOWER Maryland Energy Efficiency Act of 2008* to establish energy efficiency and demand response goals for the State. Based on 2007 electricity consumption, *EmPOWER Maryland* sets a target of 15% reduction in per capita electricity consumption and a 15% reduction target in peak demand by the end of 2015. These targets are among the most ambitious energy efficiency goals in the nation and, if achieved, would help reduce household electricity bills, address the State's electric reliability concerns, and minimize greenhouse gas emissions and other harmful pollutants.

Electric utility companies are responsible for achieving the majority of the *EmPOWER Maryland* targets. The legislation gives the Maryland Public Service Commission (PSC) the responsibility for ensuring that the utility programs achieve their goals in a cost-effective manner. Utilities submitted their first plans for achieving energy reduction goals in 2008; new plans are required to be submitted every three years thereafter. Utilities are required to submit annual progress reports to the PSC.

Renewable Portfolio Standard (RPS)

The RPS for Maryland requires that renewable sources generate 20% of Maryland's electricity by 2022, including 2% from solar.[15] Renewable energy resources are classified in the RPS statute in two tiers. Tier 1 resources include solar, wind, certain biomass, landfill methane, geothermal, ocean, fuel

[13] Maryland PSC, Case Number 9149, Order No. 82511. The "gap RFP" process was initiated by the PSC to address the possibility of a shortage in electrical capacity in Maryland as early as 2011 or 2012. The PSC ordered utilities to enter into agreements to secure approximately 400 MW of demand response capacity for summers 2011-2013.

[14] PSC Public Conference 14: *2008 Summer Reliability Status Conference*, and PSC Public Conference 18: *2009 Summer Reliability Status Conference*, at http://webapp.psc.state.md.us/Intranet/AdminDocket/index_new.cfm. PJM testimony and transcripts, at http://webapp.psc.state.md.us/Intranet/AdminDocket/index_new.cfm.

[15] Md. Public Utility Companies Code § 7-703 et seq., http://mlis.state.md.us/asp/web_statutes.asp?gpu&7-703

cell, small hydropower, and poultry litter. Tier 2 resources include hydroelectric (larger than 30 megawatts [MW]) and waste-to-energy.

The RPS creates a market-based mechanism to incentivize new generation of renewable power. Electricity suppliers demonstrate compliance with this RPS by accruing renewable energy credits (RECs). A REC is equal to the renewable attributes related to one megawatt-hour (MWh) of electricity generated using certain sources of renewable energy. A REC has a three-year life during which it may be transferred, sold, or otherwise redeemed. Starting in 2011, RECs must be generated from power projects within or delivered into the 14 state Pennsylvania-New Jersey-Maryland (PJM) region. Until the end of 2010, REC's may also be derived from PJM-adjacent states.[16] Each electricity supplier must present RECs equal to the percentage specified by the RPS statute or pay compliance fees equal to shortfalls. Generators and suppliers are allowed to trade RECs using a system approved by the Public Service Commission.[17]

Climate Action

The international scientific community has agreed that reducing greenhouse-gas (GHG) emissions is critical to mitigating the worst climate change impacts. Compared with other political entities around the world, Maryland is relatively small. However, the State is accountable for almost as many GHG emissions as Sweden and Norway combined. In addition, Maryland's per capita and statewide GHG emissions are growing faster than those of the U.S. as a whole.[18]

In 2008, Governor O'Malley signed an Executive Order that established the Maryland Commission on Climate Change.[19] Sixteen State agency heads and six members of the General Assembly serve as Commission members. Using a baseline year of 2006, the Commission has called on Maryland to reduce GHG emissions by 10% by 2012, 15% by 2015, 25-50% by 2020, and 90% by 2050.

Building on this effort, the *Greenhouse Gas Reduction Act of 2009* requires the State to reduce GHG emissions 25% from 2006 levels by 2020. The Act also directs the Department of the Environment to develop a comprehensive GHG reduction plan by 2012.

To help reduce Maryland's emissions and to assist in adapting to possible future climate change impacts upon Maryland's vulnerable coasts, farmlands, forests, and other areas, the Maryland Commission on Climate Change developed 42 recommendations for the State to address. Energy related recommendations range from adopting generation performance standards on power plants to increasing the use of energy-efficient lighting.

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[16] Ibid., http://mlis.state.md.us/asp/web_statutes.asp?gpu&7-703

[17] Public Service Commission of Maryland. *Renewable Energy Portfolio Standard Report of 2009*. February 2009. http://webapp.psc.state.md.us/Intranet/Reports/MD%20PSC%20Renewable%20Energy%20Portfolio%20Standard%20Report%20of%202009%20with%20Data%20for%20Compliance%20Year%202007.pdf, p. 2.

[18] Maryland Commission on Climate Change. *Climate Action Plan Executive Summary*. August 2008. <http://www.mde.state.md.us/assets/document/Air/ClimateChange/Executive_Summary.pdf>, p. 18.

[19] Maryland Commission on Climate Change. *Climate Action Plan Executive Summary*. August 2008. <http://www.mde.state.md.us/assets/document/Air/ClimateChange/Executive_Summary.pdf>, p. 3.

100,000 Green Jobs

An emerging "green-collar economy" has the potential to be an important component of a growing and prosperous society in the 21st century. Green jobs are employment opportunities that can help contribute to Maryland's future through the development of clean energy and/or the reduction of GHG emissions and other pollutants. Some of these jobs may involve new technologies, such as solar photovoltaic installers or smart grid operators. However, many more will be in traditional fields that will incorporate sustainable energy practices, including heating, ventilation and air conditioning (HVAC) installers, construction workers, and manufacturing.

In 2009, Governor O'Malley put forward his Administration's *Smart, Green, and Growing* legislative agenda. Among other directives, this agenda has established a target to create 100,000 green jobs in Maryland by 2015.

Examples of Green Jobs

Energy Efficiency
- Building Inspectors
- Building Operator/Building Technician
- Energy Analysis and Auditors
- Insulation Workers
- Resource Conservation/Efficiency Manager

Environmental Quality
- Environmental Engineer, Scientist
- Environmental Technician, Planner
- Environmental Program Manager
- Water & Natural Resources Scientist
- Stream Restoration Specialist
- Water Conservation Director
- Water Quality Laboratory Technician
- Water Treatment Manager
- Water Production Operator

Renewable Energy
- System Designer (Solar, Wind, Ocean)
- Test Technician (Solar, Wind, Biomass, Ocean)
- Solar Cell and Module Manufacturers
- Solar Energy Engineer
- Solar Energy System Installer
- Wind Turbine Machinists
- Wind Turbine Electrical Engineer
- Wind Field Technician

Source: Governors Workforce Investment Board

2.3 What Actions Has Maryland Taken?

Recognizing that there is no "silver bullet" that would solve our energy challenges, Maryland has adopted the "silver buckshot" approach to transform Maryland's energy marketplace for future generations and to achieve our ambitious energy goals. The State has taken numerous steps with respect to 1) conservation, energy efficiency, and demand response; 2) renewable energy development; 3)state government programs that "lead by example; 4) regulatory actions to improve the State's energy supply and demand landscape; 4) alternative transportation fuels and efficient vehicle powertrains; and 5) clean energy industry and workforce development. Below are some of the actions taken by the PSC, MEA, our utilities, and other State organizations in the last three years:

Conservation, Energy Efficiency, and Demand Response

- RGGI/SEIF Funding for Conservation, Energy Efficiency, and Demand Response

Maryland established the Strategic Energy Investment Fund (SEIF), which helps fund energy efficiency, demand response, and conservation projects, as well as low-income bill payment and general rate relief. SEIF is funded through the proceeds from the Regional Greenhouse Gas Initiative (RGGI), an effort by ten Northeast and Mid-Atlantic States to reduce carbon dioxide emissions from electricity generating plants.

- Energy Consumption and Peak Demand Reduction Targets

The major electric utilities are required by the *EmPower Maryland Energy Efficiency Act of 2008* to implement, after approval by the PSC, cost-effective energy efficiency and conservation programs designed to achieve a 10% reduction in per capita electricity usage and 15% reduction in peak demand by the end of 2015. The additional 5% reduction in per capita electricity usage will be achieved through other means.

- Utility Incentives/Decoupling

The PSC has approved decoupling (separating utility profits from energy sales volume) for the three investor-owned utilities in Maryland: Potomac Electric Power Company (PEPCO), Delmarva Power and Light (DPL), and Baltimore Gas & Electric (BGE). Natural gas decoupling has been implemented for Washington Gas Light (WGL) and BGE.

- Clean Energy Communities

The MEA has awarded grants or zero interest loans to 60 communities in FY 2009 and over 160 communities in FY2010 to leverage local government investment in energy efficiency, conservation, and renewable energy projects.

- AMI/Smart Grid

BGE piloted a Smart Grid/Advanced Metering Infrastructure (AMI) program in its service territory. BGE, PEPCO and DPL have recently submitted system-wide Smart Grid/AMI proposals to the PSC, and hearings are underway.

- Rebates for Energy Efficient Appliances

Maryland provides rebates for the purchase of ENERGY STAR-qualified appliances, including refrigerators and clothes washers. Some appliance rebates are being offered by the major electric utilities under PSC-approved EmPOWER Maryland programs.

- Energy Efficiency Standards for New and Retrofit Buildings, Education and Training for Building Code Officials

The State required the Department of Housing and Community Development adopt the International Energy Conservation Code (IECC) as part of the Maryland Building Performance Standards. The IECC specifies minimum insulation levels, HVAC performance, and lighting levels for new construction. The MEA is supporting code compliance and energy training through the Maryland community college system and independent training providers.

- Combined Heat and Power (CHP) Education and Outreach

The PSC established standard interconnection rules. Twenty CHP installations are in place in Maryland with a combined total capacity of 836 megawatts (MW).

- State-Level Appliance Standards

The *Maryland Energy Efficiency Standards Act of 2007* required the adoption of minimum efficiency standards for a number of different appliances, including bottle-type water dispensers and commercial hot food holding cabinets. Many of these items have also been included in subsequent federal legislation.

Renewable Energy Development

- Renewable Portfolio Standard

Maryland's Renewable Portfolio Standard was amended in 2007 to include a 2% carve-out for solar generation and to increase the overall requirement by more than double for all renewables, so that the goal is now 20% by 2022. This market-based incentive significantly enhances the economic viability of renewable energy projects and has triggered interest in renewable energy in every corner of the state.

- Tax Credits for Solar, Biofuels, and Wind

The *Clean Energy Incentive Tax Credit*, enacted in 2006, offers a state income tax credit for energy generated from qualified renewable sources.

- Generating Clean Horizons

MEA, the Department of General Services, and the University of Maryland have issued an RFP to jumpstart commercial scale renewables by offering a long term power purchase agreement to provide energy to the University and the State.

- Offshore Wind Planning and Development

Launched a technical study in 2009 of the potential of offshore wind and released a Request for Expressions of Interest and Information from wind energy developers interested in constructing wind energy generation facilities in Atlantic Ocean areas adjacent to Maryland's coast.

- RGGI/SEIF Funding for Renewables

The SEIF, which derives its revenue from RGGI auctions, funds multiple renewable energy projects, such as MEA's grant programs for solar, wind, and geothermal heat pumps.

Lead-by-Example in State Government

- Energy Performance Contracts

Maryland State government is leading by example through efforts of the Department of General Services and MEA. Together, the two agencies are using energy performance contracts to evaluate and install energy management improvements in State buildings. The State has leveraged approximately $250 million that will result in anticipated annual energy and operational savings of over $25 million. In addition, over 88,000 tons of CO_2 is estimated to be avoided through this energy performance contracting initiative. Several examples include:

- *Department of General Services* – 37 buildings; $18 million in anticipated contracts, $2 million annual savings
- *Spring Grove Hospital* – 38 buildings; $19.5 million in anticipated contracts; $3 million annual savings
- *University of Maryland College Park* – 9 buildings; $20 million anticipated contracts; $18 million annual savings

- Energy Reduction Plans

Every State agency has committed to reducing its energy consumption. Using a database of 15,000 state agency accounts, the Department of General Services is working with each agency to measure current energy consumption against reduction initiatives. To date, preliminary energy reduction plans have been submitted by each agency.

PSC Proceedings Related to Generation, Transmission, and Electric Reliability

- Transmission Line Proceedings

PSC has had before it two major cases relating to transmission lines. The MAPP (Mid-Atlantic Power Pathway) is proposed as a 150-mile, high voltage transmission line and PATH (Potomac-Appalachian Transmission Highline) is proposed as a 275-mile, 765 kV transmission line. A third transmission line, TrAIL (Trans-Allegheny Interstate Line), which is currently under construction, will impact Maryland, but will not physically be built in the state. Proceedings on the MAPP are under way, while proceedings relating to the PATH line are expected to begin early in 2010.

- PSC Proceedings Related to Reliability

PSC initiated a "Gap RFP" process to address the possibility of a shortage in electrical capacity in Maryland beginning as early as 2011 or 2012. The PSC ordered utilities to enter into agreements to secure approximately 400 MW of demand response capacity for summers 2011-2013 and beyond.

- PSC Proceedings Related to New Electric Generation Resources

Under its authority relating to the procurement of electricity for Standard Offer Service, (SOS), the PSC initiated a proceeding to investigate whether it should order the electric utilities to enter into long-term contracts to anchor new generation facilities, or to acquire, construct, or lease, and operate new electric generating facilities.

- Clean DG/CHP for New Generation

Maryland currently hosts combined heat and power plants situated at commercial, industrial, and institutional facilities. The Maryland PSC has removed two barriers to new generation from CHP by standardizing interconnection rules and initiating CHP-friendly standby rates.

- CPCNs for New Electric Generation Facilities

In the past year, the PSC has approved applications for a Certificate of Public Convenience and Necessity (CPCN) for a third, 1,600MW reactor at Calvert Cliffs nuclear power plant and a natural gas power plant to be located in Charles County. In 2009, the PSC also approved CPCN exemptions for two wind generation stations in Western Maryland.

PSC Challenges to Energy Market Rules

- Ongoing PSC Challenges to RPM

PJM's reliability pricing model (RPM) was designed to provide generators with longer-term pricing signals for capacity resources. Under the design of RPM, a Base Residual Auction (BRA) occurs each May, in which power generators bid capacity for a particular "power year" three years in the future. For the resources that clear the BRA, PJM makes payments in the amount of the RPM clearing price, and load serving entities pay for the capacity. Capacity charges add approximately 20% to the energy portion of the average Maryland residential electric bill.

The PSC is engaged in challenges to the RPM on several fronts:

- The PSC is actively engaged in various committees at PJM, which operates the wholesale electricity market
- The PSC is part of a multi-state effort to reform the RPM, including an RPM Symposium at PJM in January 2010. The Maryland PSC is active in (and currently is president of) the Organization of PJM States, Inc. (OPSI)
- The PSC sued PJM in 2008 seeking refunds after the RPM transitional auctions
    - The PSC formed a coalition of state PSCs, consumer advocate groups, and large industrial users and filed a complaint at FERC
    - The complaint alleged that the rates generated by the auctions were unjust and unreasonable and demanded $12 billion in refunds (approximately $2 billion for Maryland)
    - FERC dismissed the complaint, but the PSC appealed the dismissal. The case is pending before the United States Court of Appeals for the D. C. Circuit.

- PSC Participation in FERC Cases

The PSC has intervened and is participating in several wholesale market cases before the Federal Energy Regulatory Commission (FERC). PSC victories at FERC include:

- A successful challenge to an increased CONE in 2008
- The inclusion of demand response and energy efficiency as resources in the RPM
- Successful "Offer Capping" complaint, which was granted by FERC and forced a rule change worth $85 million/year to Maryland
- Successful Independent Market Monitor settlement (as part of OPSI), which will ensure an independent monitor for the wholesale electricity markets

Alternative Transportation Fuels and Efficient Vehicle Powertrains

- Transit-Oriented Development

Built extensive transit infrastructure and continue to encourage transit-oriented development. Success stories include transit development in downtown Silver Spring and Rockville in Montgomery County. Recently, Governor O'Malley announced a new "Purple Line" on the DC Metro System and a "Red Line" on Baltimore's Light Rail System.

- MEA Transportation Program

Eleven projects were funded through MEA in fiscal year 2009. These projects include the purchase of electric vehicles and hybrid trucks, the establishment of a fuel fund, installation of two E85 and biodiesel fueling pumps, and the installation of biodiesel production and collection equipment. A total of $171,133 was disbursed for these eleven projects, displacing an estimated 1.6 million gallons of fossil fuel per year.

Clean Energy Industry and Workforce Development

- Maryland Clean Energy Center (MCEC)

Maryland created the MCEC in January 2009 to help transform the energy economy in Maryland by increasing clean energy jobs, spear-heading technical innovations, supporting entrepreneurial

businesses, and encouraging widespread adoption of energy-efficient products. MCEC has partnered with the MEA in developing clean energy loan programs based on a "property assessed clean energy – PACE" model and launched a clean energy incubator program at UMBC.

- Community College Training for Audits and Retrofits

Maryland offers green job training at more than a dozen community colleges in the State. Allegheny, Anne Arundel, Baltimore City, Montgomery, and Prince George's County community colleges offer training programs such as Home Energy Analysis courses.

- Governor's Workforce Investment Board (GWIB)

Maryland issued a comprehensive study of energy workforce related issues in September 2009. The study was conducted by the GWIB, a business-led board of 45 members.

- Clean Energy Economic Development Initiative

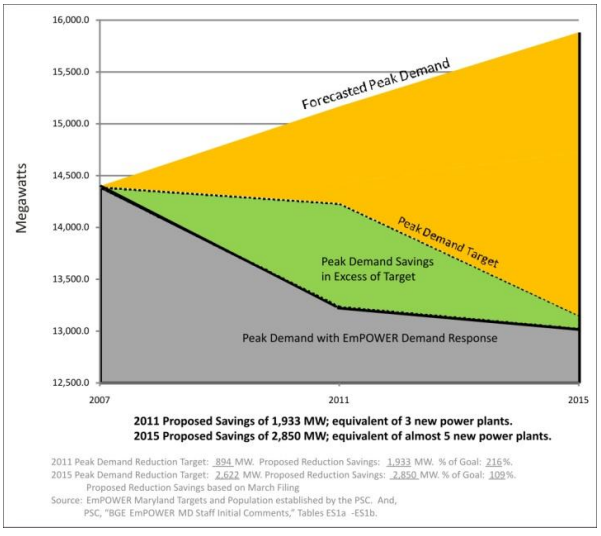
The State has established the Clean Energy Economic Development Initiative (CEEDI) Support Program to assist in the growth of a clean energy industry. The Program provides funding opportunities to businesses and organizations that are in the process of advancing new technologies, creating jobs, and furthering consumer products and services related to the clean energy sector.

2.4 What Are The Results So Far?

EmPOWER Maryland and Peak Demand Reduction

Governor O'Malley declared war on electricity peak demand – and won. According to utility filings in 2008, Maryland utilities appear well positioned (through programs approved by the PSC) to achieve the peak demand reduction goals set by *EmPOWER Maryland,* as illustrated in Exhibit 2.4. Utilities have committed to reduce peak demand by 1,933 MW in 2011, and 2,850 MW in 2015 – equivalent to avoiding five 600 MW peaking units in Maryland. The success of Maryland utilities in designing effective peak demand reduction strategies, as well as the pilot AMI programs, combined with the effects of the current economic recession and Maryland PSC's "Gap RFP" proceeding, have greatly diminished the threat of significant capacity deficits predicted only a short time ago.[20] This situation benefits all electricity consumers in Maryland.

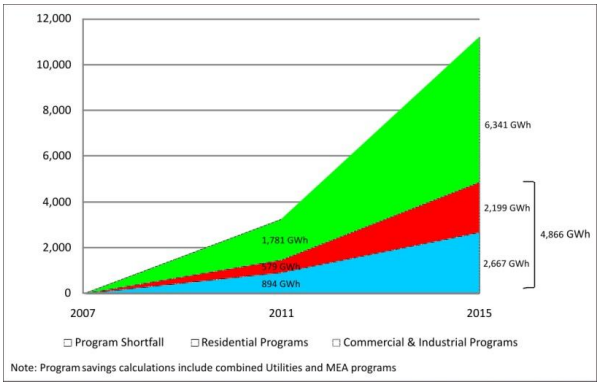
Exhibit 2.4 EmPOWER Maryland Peak Demand Reduction



[20] PSC Public Conference 14: *2008 Summer Reliability Status Conference*, and PSC Public Conference 18: *2009 Summer Reliability Status Conference*, at http://webapp.psc.state.md.us/Intranet/AdminDocket/index_new.cfm. PJM testimony and transcripts, at http://webapp.psc.state.md.us/Intranet/AdminDocket/index_new.cfm.

Maryland has also made significant progress towards reducing overall electricity consumption, as seen in Exhibit 2.5. Under the EmPOWER Maryland initiative, the PSC has approved cost-effective programs for all the major utilities that are projected to reduce statewide electricity consumption by approximately 4,670 GWh by 2015. This is equivalent to avoiding the need to build a 600 MW coal plant.[21] Nevertheless, there is still much work to be done as the State is less than half way to our overall 15% reduction goal of 11,206 GWh.

Exhibit 2.5 EmPOWER Maryland Energy Consumption Savings and Shortfall



Renewable Portfolio Standard (RPS)

Maryland is only beginning to show progress in fulfilling the State's RPS mandate. The slow progress is not surprising, however, as the changes enacted in 2008 to enhance REC prices, increase the RPS obligation, and alter the eligible territory to exclude projects outside of the PJM footprint or a control area adjacent to PJM if the electricity can be delivered into the PJM grid, do not go into effect until 2011.

Maryland's RPS program is administered by the PSC. Maryland's RPS obligations are satisfied through submission of the appropriate level of Tier 1 and Tier 2 RECs or through alternative compliance payments. One measure of success in the RPS program is the portion of obligations that are being met through renewable energy production rather than payment of compliance fees for shortfalls. In 2007, the REC shortfalls, 0.04% for Tier 1 resources and 0.08% for Tier 2 resources, were minimal. Another measure of RPS program success is the share of RECs that are generated from within the State. Maryland was the source for approximately 16% of the overall RECs used for compliance in 2007. However, when looking to the future, it appears that if Maryland is to meet a significant portion of its RPS requirement through in-state generation, new renewable sources, such as land-based and off-shore wind, must be developed.

In addition, the solar generation carve-out segment of the RPS faces obstacles. As of August 2009, cumulative PV-installed capacity registered and certified by the PSC for delivery of RECs stood at 2.34 MW. Additional behind-the-meter installations bring Maryland's total PV capacity to approximately 2.9 MW. Even with those additions, total solar installations are well short of the 5.5 MW cumulative installed capacity required to meet the solar RPS goal for 2009. In order to meet Maryland's solar RPS carve-out goal by 2018, installed capacity will need to increase to approximately 550 MW.

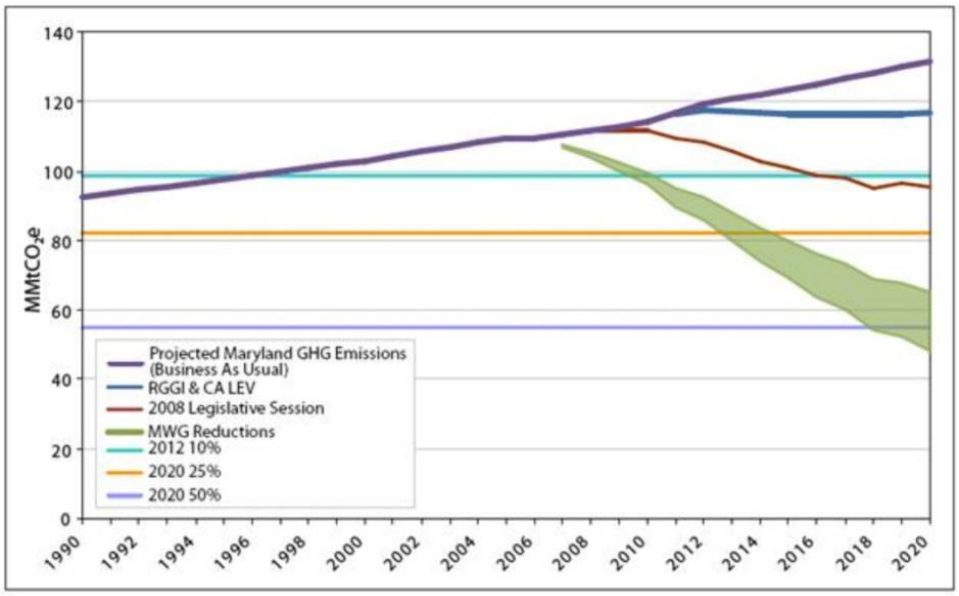
Climate Action

Most of the actions taken by the State to mitigate and adapt to climate change are too early in their planning and implementation process to realistically analyze effectiveness. For example, the *Clean Cars Act*, which became law in 2007, is focused on adopting California's stricter vehicle emission

[21] A 600 MW coal-fired plant at 80% capacity factor will generate 4,205 GWh a year. Avoiding 4,670 GWh through energy efficiency is therefore equivalent to roughly 1.15 coal plants.

standards for Maryland's fleet of automobiles. According to the Maryland Department of Environment (MDE), the *Clean Cars Act* will reduce CO_2 emissions in Maryland by 7.8 million tons per year, or 27.5% in 2025 from the 2012 baseline. However, as of 2009, no significant measurement of progress can be made due to the relative immaturity of the program.[22] Several GHG reduction scenarios identified by the Maryland Commission on Climate Change are portrayed in Exhibit 2.6.

Exhibit 2.6 Maryland GHG Emission Reduction Scenarios



Source: Maryland Commission of Climate Change, *Climate Action Plan* (August 2008)

In general, it will take a few years for programs to make a noticeable impact on State GHG emissions. It will take time to properly employ and assess the 42 options recommended in the *Maryland Climate Action Plan*. However, some progress can be observed already. The RGGI Initiative has proven to be successful, with emission auctions being conducted quarterly. The five auctions held since September 2008 have generated $84.8 million for the State, a significant portion of which is being spent on projects to reduce climate change causing emissions.

100,000 New Green Jobs

The Governors' Workforce Investment Board (GWIB) estimates that Maryland's green economy includes roughly 22,000 business units directly employing nearly 250,000 people (25% of the 2015 goal) and generating total wages of $14.6 billion.[23] Several notable firms are located within the State employing large numbers of people in green job fields. Pew ranked Maryland as fifth in the nation in attracting venture capital for clean energy investments, raising $324 million between 2006 and 2008.

[22] Maryland Department of the Environment. "Facts About… COMAR 26.11.13 and the Clean Cars Program." <http://www.mde.maryland.gov/assets/document/CALEV_Fact_Sheet.pdf>.

[23] Maryland Governor's Workforce Investment Board. *Maryland's Energy Industry Workforce Report: Preparing Today's Workers for Tomorrow's Opportunities*. September 2009. <http://www.mdworkforce.com/pub/pdf/energyworkforce.pdf>, pp. 5-6.

To attract more green firms to locate in Maryland, the State has begun to tailor educational and training programs to relevant industries. The State currently has deployed formal educational opportunities for renewable energy and energy efficiency training to expand overall green job employment. For example, MEA and DHCD have launched home weatherization and home energy auditor training programs at 16 community colleges and Maryland has already trained hundreds of weatherization technicians.

Another example includes Frostburg State University, which offers a program on design, installation, and maintenance of residential PV and wind generation systems. The program includes an 8-week online course supported by 3-day instruction and hands-on training. This education program will prepare a student for entry-level certification tests given by the North American Board of Certified Energy Practitioners, Inc. (NABCEP).[24] In addition, the University of Maryland at College Park houses the University of Maryland Energy Research Center (UMERC). The UMERC is a multidisciplinary initiative run by the School of Engineering that focuses on energy science and technology, with a special focus on alternative energy generation and storage.[25]

Maryland community colleges and universities offer numerous programs and degrees in areas that may not be limited to clean energy technologies, but provide skills that are needed by firms involved in these technology areas. Among other available resources is the newly created Maryland Center for Construction Education and Innovation at Towson University, whose purpose is to serve as a repository of information for prospective workers in the construction industry about existing training programs and other resources.[26]

2.5 What More Can We Do?

Maryland is working hard to meet its four primary energy related goals. If Maryland hopes to achieve significant additional energy efficiency improvements, GHG emission reductions, green job employment growth, and expansion of renewable energy, innovative and robust policy options must be deployed. The remainder of this *Maryland Energy Outlook (MEO)* takes a look at specific options for further decreasing energy demand; advancing renewable energy development to achieve the RPS; advancing clean energy economic development and green jobs; and increasing transportation energy independence. We *can* achieve a clean, reliable, and affordable energy future - serious consideration of these options can facilitate this goal.

[24] Interstate Renewable Energy Council. "Renewable Energy Training Catalog." August 12, 2009. <http://www.irecusa.org/trainingCatalog/providerListing.php?id=109>.
[25] University of Maryland Energy Research Center. "About the UM Energy Research Center." <http://www.umerc.umd.edu/about/index.html>.
[26] Governor's Workforce Investment Board, *Maryland's Construction Industry Workforce Report*, September 2009, www.mdworkforce.com/news/constenforum/constructionlayout.doc

3.0 Options to Decrease Energy Demand

This chapter explores policy and program options to promote achievement of the EmPOWER Maryland energy efficiency and peak demand reduction goals.

3.1 What is Maryland Currently Doing?

As discussed in Chapter 2, the *EmPOWER Maryland Energy Efficiency Act of 2008* sets ambitious energy efficiency and demand response goals for the State. Maryland's electric utility companies are responsible for achieving all peak demand reductions – 15% per capita by 2015 – called for in the legislation. In terms of total electricity consumption, the utilities are expected to achieve a 10% reduction by 2015. To achieve the overall EmPOWER Maryland goal of 15% reduction in per capita electricity consumption by 2015, an additional 5% reduction in demand must be achieved through means that are in addition to utility programs. The Maryland Strategic Energy Investment Fund (SEIF) is intended, in part, to support these additional reductions.[27]

To the extent that the Maryland Public Service Commission (PSC) determines that cost-effective energy efficiency, conservation and demand response programs and services are available for each affected retail customer class, the EmPOWER Maryland legislation gives the PSC oversight to ensure that utility programs are enacted to achieve State goals. Utilities submitted their first plans for achieving energy reduction goals in 2008; new plans are required to be submitted every three years thereafter. The 2008 plans were approved, with some modifications, in 2008 and 2009. Utilities are also required to submit annual updates to the PSC. BGE began full scale program implementation of energy efficiency programs in spring 2009. The remaining four utilities received their program approvals from the PSC in August 2009 and expect to start programs during the fall and winter of 2009/2010.

Utility Demand Response Programs

To reduce demand during peak times of electricity usage, Maryland utilities, at the PSC's direction, have launched various demand response programs. The current programs are based on the concept that utilities have the ability to turn off, or "cycle," a customer's air conditioner or water heater during a high-demand event. In order for the utility to be able to control these customer devices, a special programmable thermostat or a switch must be installed at customer premises. To entice customers to sign up for the demand response programs, they are offered financial incentives. Most utilities offer a one-time rebate when a customer signs up for the program and the controlling device is installed. In addition, participating customers receive an annual bill credit for participating in the program. Most often the credit is spread out over several months.

Even though most demand response programs have similar elements, all Maryland utilities have developed their own unique programs. For example, Baltimore Gas and Electric Company's (BGE's) *PeakRewards* program covers central air conditioning units, electric heat pumps, and water heaters, but the Potomac Electric Power Company's (Pepco's) current *Energy Wise Rewards Program* is

[27] Department of Legislative Services, HB 374 *EmPOWER Maryland Energy Efficiency Act of 2008* Fiscal Note, at http://mlis.state.md.us/2008rs/fnotes/bil_0004/hb0374.pdf. Also, HB 368 *Regional Greenhouse Gas Initiative* - Maryland Strategic Energy Investment Program, at http://mlis.state.md.us/2008rs/billfile/HB0368.htm.

limited to air conditioning units. BGE also provides its customers with the ability to manage their thermostat through the internet and override scheduled cycling events online. The level of rebates offered by the different utilities to program participants varies.

Smart Grid technologies may offer significant potential for electric peak demand reductions. BGE conducted a pilot project with more than 5,000 customers in the Baltimore area in the summer of 2008. A number of different rate designs and technologies were offered to pilot program participants. Depending on the combination of rate designs and technologies, the average load reductions over critical peak periods for program participants varied from 18% to 33%. Average total monetary savings for pilot program participants varied from $65 to $170.[28]

BGE has filed a request with the Maryland PSC to deploy its Smart Grid Initiative to all of its Maryland customers over a five-year time period. Potomac Electric Power Company (Pepco), Delmarva Power and Light Company (DPL), and Southern Maryland Electric Cooperative (SMECO) have also filed with the PSC to launch their own Smart Grid programs. The PSC is expected to rule on the utilities' applications by the end of 2009.

Utility Energy Efficiency Programs

In addition to demand response programs, the 2008 EmPOWER Maryland filings by Maryland utilities included energy efficiency and conservation programs. The purpose of these programs is to encourage utility customers to implement energy efficiency measures through financial incentives and broad-based, system-wide consumer education efforts. As with demand reduction programs, all utilities have developed their own energy efficiency programs. However, many of the programs contain similar elements. Common program features include energy audits and rebates for lighting, efficient appliances, and other efficiency measures. Typically, utilities offer a different set of programs for residential and business customers.

To date, BGE has rolled out a very comprehensive energy efficiency program in Maryland. Its *Smart Energy Savers Program* offers a wide range of efficiency services and incentives. BGE's program includes three levels of energy audits for residential customers: 1) an online do-it-yourself energy assessment; 2) a one-hour walk-through audit by a professional auditor, and 3) a comprehensive, whole-house audit as part of the *Home Performance with ENERGY STAR* program. Besides home audits, BGE provides rebates for heating and cooling system improvements, compact fluorescent light bulbs, refrigerators, clothes washers, room air conditioners, and removal of old inefficient refrigerators and freezers. The company also offers a program to provide energy saving services and improvements for limited-income households. For business customers, BGE offers incentives for efficient lighting, motors, heating and cooling equipment, variable frequency drives, commercial refrigeration and kitchen equipment, and retro-commissioning of facilities. Custom rebates are also available for cost-effective site-specific energy efficiency measures. Four other major utilities – Pepco, Delmarva, Allegheny and SMECO – recently received PSC approval to implement energy efficiency programs in the residential, commercial and industrial sectors similar to those offered by BGE.

[28] BGE Smart Grid Initiative filing with Maryland PSC, July 13, 2009.

Strategic Energy Investment Fund (SEIF) Programs

The Maryland Strategic Energy Investment Fund (SEIF) was established in 2008 to utilize the proceeds from the Regional Greenhouse Gas Initiative (RGGI) emission allowance auctions. According to the enabling legislation, the purpose of the fund is "to decrease energy demand and increase energy supply to promote affordable, reliable, and clean energy to fuel Maryland's future prosperity."

The RGGI emissions allowance auctions are held quarterly. In the five auctions conducted since September 2008, Maryland has received a total of $84.8 million in proceeds.[29]

Monies in SEIF are allocated according to the following formula set in the legislation. The formula was temporarily modified by the Budget Reduction Act of 2008 for FY2010 and FY2011, with the revised percentages shown in parenthesis:

- 23% to residential rate relief
- 17% (up to 50%) to low and moderate income energy assistance (administered by the Department of Human Resources)
- 46% (at least 17.5%) to energy efficiency, conservation and demand response programs (of which half must be used for low and moderate income family programs)
- 10.5% (at least 6.5%) to clean energy and climate change programs, and outreach and education
- 3.5% (3%) to administer the Fund

Except for the low-income energy assistance program managed by the Department of Human Resources, the Maryland Energy Administration (MEA) is tasked with developing and managing the energy efficiency and clean energy programs funded by the SEIF. MEA has launched the following energy efficiency programs under SEIF for FY 2010:

- Community Energy Efficiency Low-to-Moderate Income Grants
- Jane E. Lawton Conservation Loan Program
- Energy Efficiency Grants for Multi-Family Buildings with DHCD
- Specialized Industrial and Commercial Energy Assessments
- Farm Energy Technical Assistance and Incentives
- Financial Incentives for Commercial/Industrial/Institutional Custom Electricity Reduction Projects
- State Agency Loan Program (SALP)
- Public Outreach Campaign

3. 2 What Are the Results So Far?

As seen in Exhibit 2.1 in Chapter 2, Maryland utilities appear to be well positioned to achieve the peak demand reduction goals set by EmPOWER Maryland. However, achieving the electricity consumption reduction goals will require additional efforts, as seen in Exhibit 2.2.

[29] Regional Greenhouse Gas Initiative, http://www.rggi.org/co2-auctions/results

3. 3 What More Can We Do?

Additional utility programs are expected to be developed over the intervening years to continue to assist with achieving the EmPOWER Maryland goals. For example, advanced meter and smart grid initiatives, currently pending before the PSC, may offer the promise to make a significant contribution. Independent of the utility programs, MEA efforts, such as those supported through the SEIF, will also assist in obtaining the overall 15% reductions in electricity consumption required by 2015.[30]

Achieving the EmPOWER Maryland energy efficiency goals will require a multi-pronged approach. Thus, the State should evaluate other programs and policies to ensure that EmPOWER Maryland goals are achieved.

During the *Maryland Energy Outlook* development process numerous additional financial incentives and various policy changes were considered. To incent energy efficiency retrofits and high-performance buildings, additional financing mechanism, tax incentives, benchmarking of buildings, and time-of-sale disclosure requirements were analyzed. Options to further strengthen building energy codes and appliance standards were also considered, along with lead-by-example programs.

Based on policies and programs that already exist and potential for efficiency improvements, the most promising options were selected for further analysis. These options are:

- Time-of-Sale Disclosure of Energy Performance for Residential and Commercial Buildings
- Tax Credits for Zero Energy and Zero Energy Ready Buildings
- Combined Heat and Power (CHP) Initiatives

3.3.1 Time-of-Sale Disclosure of Energy Performance for Residential and Commercial Buildings

What is a Time-of-Sale Disclosure Requirement of Energy Performance?

A time-of-sale disclosure requirement of energy performance provides information about a building's energy use to a prospective buyer. Ideally, this information would be provided at time of *listing* to better inform prospective purchaser's decision making. An energy performance disclosure requirement would enter energy efficiency information into the marketplace and drive the market toward more efficient buildings. There are many ways this information can be disclosed to a buyer.

In its simplest form, energy performance disclosure provides prospective buyers with information about the building's energy consumption and/or energy costs for the previous year(s). To provide more comprehensive information about a building's actual energy performance, conducting an energy audit of the property could be required prior to listing it for sale. If such an audit requirement is developed, uniform standards for the audits need to be used. For example, the Residential Energy Services Network's (RESNET's) *Home Energy Rating System* (HERS) can be

[30] Department of Legislative Services, HB 374 *EmPOWER Maryland Energy Efficiency Act of 2008* Fiscal Note, at http://mlis.state.md.us/2008rs/fnotes/bil_0004/hb0374.pdf

adopted as the standard for home energy audits. In the commercial sector, the energy assessments could be conducted using the *EPA ENERGY STAR Portfolio Manager* tool.

If a time-of-sale disclosure requirement is adopted, how best should the information be shared with prospective buyers? One possibility is to include it in the Multiple Listing Service (MLS) for the property. Alternatively, the information could be made available to the buyer prior to completing the sale.

What is Maryland's Experience Regarding Time-of-Sale Disclosure?

Maryland has not imposed any statewide requirements regarding time-of-sale disclosure of energy performance. However, Montgomery County passed legislation in 2008 that requires home sellers to provide energy consumption and cost history to prospective buyers.[31]

The Montgomery County law became effective January 1, 2009. It applies to attached and detached single family homes. Prior to signing a sales contract for a home, the seller is to provide copies of electricity, gas, and home heating oil bills, or a cost and usage history, for the past 12 months immediately prior to the sale. The law also requires that the seller provides the buyer with information to assist home buyers in making energy conservation decisions. These informational materials must be approved by the Montgomery County Department of Environmental Protection (MCDEP). The law does not require that an energy audit be conducted before the sale, even though such a requirement was included in the original legislative proposal. There is no mechanism in place to try to estimate actual energy savings that will result from the disclosure requirement law.[32]

The MCDEP worked with the Greater Capital Area Association of Realtors to develop informational materials related to the requirements of the law, including legal disclosure requirements, recommended format for disclosing home energy consumption and cost information, and the energy efficiency information resources to be provided to the buyer.[33] According to MCDEP, there have been no major implementation problems or consumer backlash in the first year of the disclosure requirement.[34]

What Are Other States' Experiences Regarding Residential Disclosure?

Time-of-sale energy performance disclosure requirements are a relatively new tool to enhance energy efficiency in the real estate market place, but some states and localities have enacted policies in this area:

Berkeley, California

The City of Berkeley has had a Residential Energy Conservation Ordinance on the books since 1987, and it has been updated several times since then. This ordinance requires that the seller of a residential property install certain energy conservation measures prior to selling the property. The required efficiency measures include adequate ceiling insulation, sealing HVAC system ducts, and installing low-flow shower heads and faucets. The seller of the property must receive a certificate of

[31] Montgomery County Council Bill 31-07, http://www.montgomerycountymd.gov/content/council/pdf/bill/2008/20080422_31-07.PDF
[32] Montgomery County Department of Environmental Protection (MCDEP), phone conversation with Eric Coffman, October 15, 2009
[33] Maryland Homeowners' Association, blog post December 22, 2008, http://mdhoa.blogspot.com/
[34] MCDEP, phone conversation with Eric Coffman, October 15, 2009

compliance from the city prior to completing the sale. Although results data is scarce, energy savings in the 15-25% range have been reported.

Austin, Texas

The City of Austin's Energy Conservation Audit and Disclosure Ordinance took effect June 1, 2009. The ordinance requires home sellers in the City of Austin who are electricity customers of Austin Energy to conduct an energy audit performed by either a BPI (Building Performance Institute) or RESNET (Residential Energy Services Network) certified auditor. The audit covers attic insulation levels, duct system testing, HVAC equipment, weather stripping, and sun-exposed window area. Austin Energy estimates that an audit for a typical single family home costs $200-$300.[35]

The Energy Conservation Audit and Disclosure Ordinance is an important component of the city's strategy to achieve 700 MW of energy savings by 2020 under the Austin Climate Protection Plan. The city's goal is that by 2013, cost-effective energy efficiency improvements will be made in 85% of sold residential properties within one year of sale closing.[36] According to Austin Energy, no projections about estimated actual energy savings specific to the audit and disclosure requirement have been made. The requirement to conduct audits will assist the city in achieving its overall energy reduction goal by helping the utility identify properties with energy efficiency improvement potential.[37]

Kansas

A 2007 Kansas law requires a builder of a new home to disclose specific energy information about the home at time of closing. The required information includes insulation values for the attic, walls, and foundation; window U-values; heating and cooling system efficiency; and water heating efficiency.[38] Actual energy use impacts of the disclosure requirement has not been analyzed. The requirement is considered a purely informational and educational tool for homebuyers and builders.[39]

Nevada

Nevada requires that sellers of residential properties must provide an energy evaluation prior to completing the sale transaction.[40] The Nevada State Office of Energy has developed guidelines for the energy assessment. The enabling legislation provides some exemptions from the disclosure requirement, including sales of foreclosed properties, transactions between close relatives, and transactions where both seller and buyer agree to waive the requirement. An efficiency evaluation completed within five years of the sale is considered valid. The program regulations are required to be developed by January 2011; the disclosure requirement will not be in effect until the regulations are adopted.[41]

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[35] Austin Energy, *Energy Conservation Audit and Disclosure Ordinance*, http://www.austinenergy.com/about%20us/environmental%20initiatives/ordinance/ecadOrdinanceHomes.pdf
[36] Austin City Council, Resolution No. 20081106-048, http://www.austinenergy.com/About%20Us/Environmental%20Initiatives/ordinance/councilResolution.pdf
[37] Austin Energy, Tim Art, phone contact October 27, 2009
[38] *Kansas Energy Efficiency Disclosure* form, http://www.kcc.state.ks.us/energy/energy_efficiency_disclosure.pdf
[39] Kansas Corporation Commission, State Energy Office, email correspondence with Liz Brosius, October 27, 2009
[40] Nevada Senate Bill No. 437 (2007), http://www.leg.state.nv.us/74th/Bills/SB/SB437_EN.pdf
[41] Nevada State Office of Energy, phone conversation with Kim Fischer, October 15, 2009.

Voluntary Disclosure

Alaska, Colorado, Rhode Island, and Florida allow voluntary disclosure of a HERS rating on the MLS. Florida has also created a database of all rated homes in the State to enable people to search for the rating for a specific address.[42]

What Are Other States' Experiences Regarding Commercial Disclosure?

California

A 2007 California law requires electric and gas utilities to maintain records of energy consumption data for all non-residential buildings to which they provide service. The information is required to be uploaded into the U.S. Environmental Protection Agency's *ENERGY STAR Portfolio Manager*, for at least the most recent 12 months. As of January 2010, a non-residential building owner or operator will be required to disclose *ENERGY STAR Portfolio Manager* benchmarking data and ratings, for the most recent 12-month period, to a prospective buyer, lessee, or lender.[43]

Washington D.C.

The *Clean and Affordable Energy Act of 2008* establishes a requirement for the District to benchmark all of its own buildings greater than 10,000 square feet. The benchmarking is to be done annually utilizing the ENERGY STAR Portfolio Manager tool. Starting in 2010, annual benchmarking of privately owned buildings will also be required. The private sector requirement will be phased in, starting with buildings of more than 200,000 square feet in 2010. By 2013, all privately owned buildings of more than 50,000 square feet are to be benchmarked. The benchmarking results are to be made public through the District of Columbia Department of the Environment website.[44]

How Will Time-of-Sale Disclosure Help Achieve Maryland Goals?

Maryland's existing energy efficiency programs primarily focus on addressing financial barriers to energy efficiency implementation. However, lack of information about the energy performance of residential and commercial buildings also stands in the way of wise consumer choices. For example, commercial building owners may not have any information about the energy performance of a building compared to other similar buildings, and so may not realize that significant efficiency improvements could be implemented. On the residential side, energy efficiency is an issue that a prospective buyer should consider at the time of sale, but it is not a quality that he/she can easily observe in a normal walk-through.

Time-of-sale disclosure requirements would create positive market "pull" to bolster the EmPOWER Maryland goals. Residential and commercial building sellers would be more likely to implement energy efficiency improvements prior to sale if they know energy information will be disclosed to prospective buyers. Similarly, buyers would pay attention to energy consumption if energy information were provided for *all* buildings in the market. Buyers will want to purchase properties with good energy performance, creating higher demand for efficient buildings and lessening demand for inefficient ones.

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[42] MEA, Maryland Strategic Electricity Plan, January 2008, page 29

[43] California Public Resources Code, Section 25402.10, http://www.leginfo.ca.gov/cgi-bin/displaycode?section=prc&group=25001-26000&file=25400-25405.6

[44] Washington D.C. Clean and Affordable Energy Act of 2008, http://bcap-energy.org/files/DC_Clean_Affordable_Energy_Act_2008.pdf

Time-of-sale disclosure requirements do have a cost impact, depending on the type of audit conducted. Historical energy use and cost information for prospective buyers is available through utility companies and imposes negligible burdens on the seller. If a requirement to conduct an energy audit prior to sale is adopted, costs will depend on the type of audit that is required and the size and type of the building being evaluated. The City of Austin estimates that the type of audit it requires will cost $200-$300 for an average home. More extensive audits can cost more. For example, obtaining a HERS rating in Maryland typically costs $300-$700.[45]

EPA's ENERGY STAR Portfolio Manager tool for evaluating commercial building energy performance is available free of charge. However, to actually conduct the evaluation requires a time commitment by either in-house staff or an outside vendor. In either case, the building owner incurs costs for the actual energy audit.

What are the Advantages and Disadvantages of a Time-of-Sale Disclosure Requirement?

Advantages include:

- Creates an incentive for sellers to make energy efficiency investments prior to the sale of a property.
- Addresses a market failure by making it easier for energy efficiency to be incorporated into market decisions.
- Strengthens market for, and increases value of, energy-efficient buildings.
- Disclosure of energy consumption and cost information is administratively easy and incurs negligible cost to building owners.
- The requirement to conduct an energy audit, such as a HERS rating or *ENERGY STAR Portfolio Manager* analysis, provides an accurate and comprehensive analysis of a building's energy performance.
- Minimal budget impact for the State.

Disadvantages include:

- Historical energy consumption and cost data may provide insufficient information about a building's actual energy-efficiency. The energy consumption habits of building occupants have a significant impact on energy consumption, and therefore energy use can vary widely for homes of similar size and characteristics.
- If a comprehensive analysis of a building's energy performance is required, it would impose an additional cost to home sale transactions.
- Any additional barriers to sale transactions can further weaken today's slow real estate market.
- If demand for energy audits increases significantly, there may not be adequate numbers of qualified auditors. This would need to be addressed by supporting auditor training and qualification efforts.
- The actual energy reduction impacts that result from the disclosure requirement are difficult to estimate.

[45] MEA, Maryland Strategic Electricity Plan, January 2008, page 29.

3.3.2 Tax Credits for Zero Energy and Zero Energy Ready Buildings

What are Tax Credits for Zero Energy and Zero Energy Ready Buildings?

In the design and building communities, great emphasis is being placed on developing technologies that go far beyond current existing building efficiency standards. The U.S. Department of Energy (DOE) defines a zero energy building as a residential or commercial building with greatly reduced needs for energy through efficiency gains (60% - 70% less than conventional practice), with the balance of energy needs supplied by renewable technologies. DOE is creating technologies and design approaches that will lead to marketable zero energy homes by 2020 and zero energy commercial buildings by 2025.[46] While zero energy and zero energy ready buildings do exist in the U.S., they are not widespread across the nation.

In 2007, the United Kingdom announced a goal of building all new homes as carbon-neutral by 2016.[47] The *2030 Challenge*, issued by Architecture 2030, calls for building professionals to design and build carbon-neutral buildings by the year 2030. Architecture 2030 believes this goal can be accomplished by implementing innovative sustainable design strategies, generating on-site renewable power, and/or purchasing renewable energy credits.[48]

Realizing that the cost of onsite renewable energy generation can be prohibitive at this time and a major obstacle to the construction of carbon neutral buildings, some building professionals talk about the concept of "zero energy ready buildings" as an interim step towards achieving the long-term goal. A zero energy ready building is constructed with the idea that on-site renewable energy generation can be easily incorporated into the building once it is cost-effective. The "passive house" ("passivhaus") design is an example of a zero energy ready building already in existence.[49] It is estimated that approximately 15,000 such homes already exist around the world. In Germany, the cost of a passive house has been estimated to be 5-7 % higher than a conventional house.[50]

To incentivize the construction of zero energy and zero energy ready buildings, income tax credits could be established for builders and contractors. In Maryland, the tax credits could be implemented by extending and modifying the State's existing Commercial Green Building Tax Credit program to specify energy savings levels for buildings.

What is Maryland's Experience Regarding Tax Credits for High-Performance Buildings?

Through the Commercial Green Building Tax Credit program, personal and corporate income tax credits of 6-8% are available for residential and non-residential buildings of at least 20,000 square feet that are constructed or rehabilitated to meet the Leadership in Energy Efficiency Design (LEED) criteria. In addition to meeting the LEED criteria, new buildings are required to use 35% less energy than required by ASHRAE 90.1-1999; rehabilitated buildings must use 25% below the

[46] U.S. DOE, Building Technologies Program, http://www1.eere.energy.gov/buildings/goals.html
[47] Department of Communities and Local Government (UK), *Building a Greener Future: Policy Statement*, http://www.communities.gov.uk/documents/planningandbuilding/pdf/building-greener.pdf
[48] Architecture 2030, http://www.architecture2030.org/
[49] Passive House Institute, http://www.passiv.de/07_eng/index_e.html
[50] The New York Times, No Furnaces but Heat Aplenty in 'Passive Houses', December 26, 2008,, http://www.nytimes.com/2008/12/27/world/europe/27house.html

ASHRAE standard. Over the life of the program, $25 million in tax credits will have been made available. At this time, all of the available credits have been allocated.[51]

Created in 2001, the Green Building Tax Credit program is administered by the MEA. In order to qualify for the credit, the building project must be in a qualified brownfield site or a priority funding area as designated by the Maryland Department of Planning. The $25 million in credits available through the program have been distributed between 18 construction projects around the State. The total square footage of these building projects is approximately 2.4 million. The MEA estimates that the projects will achieve an average of 35% energy savings, or total savings of approximately 41.5 billion Btu per year.[52]

At the local level, Montgomery and Howard counties provide optional property tax credits for high performance buildings. The State also allows local governments to provide property tax credits for solar, geothermal and "qualifying energy conservation devices"; five Maryland counties have established such credits for one or more technologies.[53]

What Are Other States' Experiences with Tax Credits for High-Performance Buildings?

Based on review of state incentives in the Database of State Incentives for Renewables and Efficiency (DSIRE), no states have been identified as offering tax incentives specifically aimed at zero energy or zero energy ready buildings. A handful of states provide tax incentives similar to Maryland's Green Building Tax Credits for high-performance buildings. Arizona and New Mexico are the only states that offer tax incentives for high-performance residential buildings. Maryland, New Mexico and New York are the only states that provide tax incentives for high-performing larger commercial buildings or multi-family dwellings. (Eight states provide tax incentives for implementing energy efficiency measures, but these incentives are not tied to the building's overall energy performance.) [54]

Arizona

Arizona provides an individual income tax subtraction to the original owner of a new energy efficient home. The deduction may be claimed in the year that the house is sold. It is equal to 5% of the sales price and cannot exceed $5,000. The tax subtraction is available for new single family-residences, condominiums, or townhouses that exceed the 1995 Model Energy Code Threshold by at least 50% (90 points) as determined by an approved rating program. The subtraction is valid for taxable years beginning after December 31, 2001 and ending before December 31, 2010.[55]

New Mexico

New Mexico established a personal tax credit and a corporate tax credit for sustainable buildings in 2007. The amount of the credit varies according to the square footage of the building and the level of certification achieved. For commercial properties, a LEED certification and energy performance that is 50% better than a typical building of similar type is required. For residential homes, certifications are based on LEED or the Build Green New Mexico rating system; energy

[51] MEA, Green Building Tax Credit program, http://energy.maryland.gov/incentives/business/greenbuilding/index.asp
[52] MEA, Green Building Tax Credit program data
[53] Database of State Incentives for Renewables and Efficiency (DSIRE), http://www.dsireusa.org/
[54] DSIRE, http://www.dsireusa.org/
[55] Southwest Energy Efficiency Project, http://www.swenergy.org/buildingefficiency/zeh/incentives.htm

performance that is 40% better than a code compliant building is also required. For manufactured homes, the program requires an ENERGY STAR certification. The amount of the tax credit is based on the qualified occupied square footage of the building and the sustainable building rating achieved. The State grants $5 million worth of certificates for commercial buildings and $5 million for residential buildings per calendar year.

According to the New Mexico Energy, Minerals, and Natural Resources Department, less than one-fifth of the available credits have been used in years 2007, 2008 and 2009. [56] Despite this, the program is considered a success and ramp-up in number of tax credit applications has been faster than expected – especially in light of current economic conditions and slow real estate market. For the residential tax credits, the number of application increased from only two in the program's first year in 2007 to approximately 100 applications in 2008. It is expected that approximately 200 applications will be received in 2009. It is estimated that the 100 residential homes that received credits in 2008 yield 4.3 billion Btu's in annual energy savings compared to average code compliant homes. For commercial buildings that received credits in 2008, the annual energy savings are estimated at 3.3 billion Btu's.[57]

New York

In 2000 New York established a Green Building Tax Credit to owners and tenants of eligible buildings which meet certain "green" standards. The original legislation allowed applicants to apply for the credits in years 2001-2004 and to claim the credits over five years. The program was extended in 2005, allowing applicants to apply for credits from 2005-2009, with nine years to claim the credits. The original law provided for $25 million in credit certificates; the 2005 legislation added another $25 million. The 2005 legislation also caps incentives at $2 million per building in aggregate.[58]

This tax credit has had mixed results. According to the New York State Department of Environmental Conservation, only seven buildings have applied for this tax credit since the program's inception in 2000.[59]

How Will Tax Credits for Zero Energy and Zero Energy Ready Buildings Help Achieve Maryland Goals?

Buildings consume more than 70% of electricity and 40% of total energy consumed in the U.S.[60] Thus, addressing building energy efficiency is a very important part of a comprehensive energy efficiency strategy. Because buildings have long lifetimes and are difficult and costly to retrofit, it is most cost effective to address energy efficiency when buildings are first built. Mandatory building energy codes are the primary tool to ensure that new buildings are energy efficient. The Maryland Department of Housing and Community Development (DHCD) adopts, on a three-year cycle, the latest iteration of the International Energy Conservation Code (IECC) within 12 months of its promulgation, and local governments must implement and enforce the most current code within six

[56] New Mexico Energy, Minerals, and Natural Resources Department, Sustainable Building Tax Credit, http://www.emnrd.state.nm.us/ECMD/CleanEnergyTaxIncentives/sustainablebuildingtaxcredit.htm
[57] New Mexico Energy, Minerals, and Natural Resources Department, Susie Marbury, phone conversation on November 9, 2009.
[58] New York State Department of Environmental Conservation, http://www.dec.ny.gov/energy/1540.html
[59] New York State Department of Environmental Conservation, phone conversation October 19, 2009.
[60] ACEEE, *The 2008 State Energy Efficiency Scorecard*, page 24.

months of adoption by DHCD.[61] The 2009 IECC for both residential and commercial buildings became effective in Maryland on October 1, 2009. The new code is expected to yield additional energy savings of approximately 15% compared to the 2006 IECC.[62]

As the experience with the Maryland Commercial Green Building Tax Credit program has shown, tax incentives can be an effective tool to push building owners and developers towards even greater efficiency – beyond the existing building energy code – in new and renovated buildings. While Maryland could choose to continue its currently successful tax credit program, it should consider establishing a new incentive program with even more stringent energy efficiency criteria

Since the DOE is working toward technologies and design approaches that lead to marketable zero energy homes by 2020 and zero energy commercial buildings by 2025,[63] it makes sense for Maryland to support building construction with similar targets. Zero energy and zero energy ready buildings should meet very stringent efficiency criteria, similar to the efficiency guidelines developed by the *2030 Challenge* of the Architecture 2030 initiative. The *2030 Challenge* sets a "fossil fuel reduction standard" (compared to the regional average for that building type) for all new buildings and major renovations. This proposed standard is 60% reduction in 2010, 70% in 2015, 80% in 2020, 90% in 2025, and finally carbon-neutral in 2030.[64]

Following New Mexico and Arizona's example, Maryland should consider expanding the tax credit program to residential buildings. It would be beneficial for the State to incent market transformation in both commercial and residential building sectors.

What Are the Advantages and Disadvantages of Tax Credits for Zero Energy and Zero Energy Ready Buildings?

Advantages include:

- Incentivizes market transformation toward highly efficient buildings. If both residential and commercial buildings are included in the program, it would enhance market transformation in both sectors. (Current Maryland tax credits are not available for small residential buildings.)
- Focuses on "cutting-edge" and innovative designs and technologies, instead of building solutions that may have already gained customer acceptance and significant market share.
- Focuses on the building sector, which consumes more than 70% of electricity and 40% of total energy consumed in the U.S.[65]
- By capping total tax credits to be made available, cost of incentive program is known.

Disadvantages include:

- Additional State appropriations are needed to establish a tax credit program. Under current State fiscal situation, this can be a major challenge.

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[61] Senate Bill 625 (2009), http://mlis.state.md.us/2009rs/billfile/SB0625.htm
[62] Buildings Codes Assistance Project, *Building Codes & Efficiency: Maryland* factsheet, February 2009, http://bcap-energy.org/files/Maryland_Fact_Sheet.pdf
[63] U.S. DOE, Building Technologies Program, http://www1.eere.energy.gov/buildings/goals.html
[64] Architecture 2030, http://www.architecture2030.org/2030_challenge/index.html
[65] ACEEE, *The 2008 State Energy Efficiency Scorecard*, page 24.

- Establishing very stringent efficiency standards and renewable energy production requirements is likely to increase construction costs and require use of technologies that may not be cost-effective.
- If established standards are too stringent, few projects may apply for credits and funds may go unused.
- Since no similar standards exist in other states, additional resources will be needed to establish program standards and guidelines.

3.3.3 Combined Heat and Power (CHP) Initiatives

What is Combined Heat and Power (CHP)?

Combined heat and power (CHP) applications are integrated systems that generate both electricity and thermal energy. Because CHP systems utilize the heat that is normally lost in electricity generation, these systems are significantly more efficient than separate systems for electricity and thermal energy generation. CHP systems utilize the recovered energy to serve an existing thermal load, such as facility's water heating needs or process heat at industrial facilities.

Maryland's 20 CHP facilities have a combined total capacity of 836 MW[66]. Natural gas is the primary fuel used for powering existing CHP facilities in the State, and the Department of Natural Resources (DNR) Power Plant Research Program (PPRP) expects natural gas-fired systems to dominate new CHP construction efforts in the future. [67]

CHP faces a number of barriers to more aggressive development, including regulatory hurdles, utility requirements, and the high cost of feasibility studies. High and volatile natural gas prices over the last few years[68] have been another significant factor limiting further CHP deployment. When natural gas prices rise, the economic viability of a CHP system diminishes. While the PSC and MEA are promoting CHP deployment in Maryland, additional initiatives could be taken to make CHP a more attractive option for businesses, public and private institutions, and utilities.

What is Maryland's Experience with CHP?

Despite CHP's many potential energy efficiency benefits, the business case for installing CHP in Maryland has been less than compelling. High natural gas prices relative to historic electricity rates and air permitting policies that fail to credit displaced emissions in place of increased onsite emissions at CHP sites have historically been two main factors for the lack of CHP installations in the State.[69]

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[66] Energy and Environmental Analysis Inc. /ICF International, Combined Heat and Power Installation Database, Last updated 1/21/09. http://www.eea-inc.com/chpdata/States/MD.html

[67] Maryland Power Plant Research Program, *Inventory and Analysis of Combined Heat and Power Systems in Maryland*, April 2006; http://esm.versar.com/PPRP/bibliography/PPES_06_03/PPES_06_03.pdf

[68] EIA, *Natural Gas Prices*, http://tonto.eia.doe.gov/dnav/ng/ng_pri_sum_dcu_nus_m.htm

[69] American Council for an Energy-Efficient Economy, "Energy Efficiency, The First Fuel for a Clean Energy Future, Resources for Meeting Maryland's Electricity Needs," February 2008, http://www.aceee.org/pubs/e082.htm..

However, Maryland currently has some policies in place to encourage CHP, including a PSC-approved standard interconnection rule that includes all DG systems up to 10 MW in size[70]: Baltimore Gas and Electric's (BGE) Schedule S and Allegheny Power's Schedule AGS both have standby rates that are considered neutral to CHP.[71] In addition, the PSC is currently considering proposals intended to remove certain utility DG rate and practice barriers and to provide incentives for CHP.

What Are Other States' Experiences with CHP?

An examination of other states' successful CHP policies provides perspective on where Maryland's policies rank, as well as input on policies that can be considered to further encourage CHP. In ACEEE's *State Energy Efficiency Scorecard,* states are scored on a scale of 0 to 5 on CHP-related policies and programs, based on this order of importance:

- Standard interconnection rules
- Status of CHP-friendly standby rates
- Presence of CHP financial incentive programs
- Presence of output-based emissions regulations
- Inclusion of CHP/waste heat recovery in a state renewable portfolio standard (RPS) or energy efficiency resource standard (EERS)

With a total score of 3, Maryland ranked eighteenth among the 50 states and District of Columbia. Exhibit 3.1 illustrates selected top-ranked states and Maryland.[72]

Exhibit 3.1: State Scoring for CHP – Selected Top-Ranked States and Maryland (2009)

State	Interconnection	Standby Rates	Financial Incentives	Output-Based Emissions Regulations	RPS/EERS	Rank	Overall Score
OH	6	2	4	++	++	2	5
TX	6	3	0	+++	++	3	5
IL	6	3	0	+++		6	5
MD	6	3	0			18	3

Source: American Council for an Energy-Efficient Economy, "The 2009 State Energy Efficiency Scorecard." October 2009. < http://www.aceee.org/pubs/e097.htm >, p. 36.

Note on ACEEE scoring: Each policy is scored separately using differing scales. Overall score is a weighted average of the five policy scores, with 5 being the highest overall score.

Ohio

Ohio has several CHP-friendly policies in place, including exemplary interconnection standards, an Alternative Energy Resource Standard that includes CHP as a qualified alternative energy resource, and several financial incentives. In particular, Ohio's interconnection standard policy—which was

[70] American Council for an Energy-Efficient Economy. "Maryland Clean Distributed Generation." August 27, 2009. <http://www.aceee.org/energy/state/maryland/md_dg.htm>.

[71] BGE charges the actual energy under the regular rate. Allegheny Power uses real-time pricing for moderate demand and energy charges. No ratchet exists for either of these rates. Source: American Council for an Energy-Efficient Economy. "Maryland Clean Distributed Generation." August 27, 2009. <http://www.aceee.org/energy/state/maryland/md_dg.htm>.

[72] American Council for an Energy-Efficient Economy, "The 2009 State Energy Efficiency Scorecard." October 2009. < http://www.aceee.org/pubs/e097.htm >, pp. 34-37.

established in 2007—is a good example for other states to follow. With three size tiers and systems up to 20 MW eligible for grid interconnection, Ohio's policy is particularly favorable to CHP since the tier system enables smaller CHP systems to have a faster (and often cheaper) path to interconnection, and the higher interconnection limit of 20 MW is preferred by CHP developers.[73]

Texas

Texas has been a leader in establishing CHP-friendly policies. Texas's interconnection policy has been in place since 1999. Like Maryland's interconnection policy, the Texas policy applies to systems up to 10 MW. CHP is also included as a key component of Texas's Energy Efficiency Goal, and Texas's emissions regulations provide credit for thermal output for highly-efficient CHP systems. Texas also has CHP-friendly standby rates. Though Texas has few financial incentives for CHP, it has the most installed CHP capacity of any state.[74]

Illinois

Illinois has a tiered interconnection policy, established in 2008, for systems up to 10 MW of capacity, and currently has an open docket to explore rules for requests for systems larger than 10 MW. In addition to establishing output-based emissions regulations, Illinois allows CHP to be eligible for energy-efficiency set-aside allowances.[75]

What CHP Initiatives Should Maryland Consider?

As Maryland business and industrial leaders investigate CHP opportunities at their facilities, they may encounter a number of barriers. As suggested in *Maryland's Energy Future Energy Transition Report*, the MEA should focus on barrier-removing strategies specifically for CHP and use other states' experiences in removing them in Maryland.[76] To promote CHP development, financial incentives that require funding (e.g., loans, tax credits, grants, buy-downs, favorable fuel rates, and generation incentives) and/or regulatory or policy initiatives that do not require funding (e.g., standardized interconnection, inclusion of CHP in portfolio standards, and CHP-friendly standby rates) could be implemented.[77]

Specific CHP initiatives for Maryland include:

- Adoption of new regulations and policies friendly to clean DG
- Exploration of large-scale CHP projects
- Establishment of financial incentives for CHP
- Aggressive CHP education and outreach

[73] American Council for an Energy-Efficient Economy, "The 2009 State Energy Efficiency Scorecard." October 2009. < http://www.aceee.org/pubs/e097.htm >, p. 37.
[74] ACEEE, "The 2009 State Energy Efficiency Scorecard." October 2009. < http://www.aceee.org/pubs/e097.htm >, p. 37.
[75] ACEEE, "The 2009 State Energy Efficiency Scorecard." October 2009. < http://www.aceee.org/pubs/e097.htm >, p. 37.
[76] Maryland Energy Transition Team. "Maryland's Energy Future – Energy Transition Report 2007." February 2007. <http://www.gov.state.md.us/documents/transition/Energy.pdf>.
[77] Maryland Public Service Commission. Demand Response/Distributed Generation Working Group. "EPA Maryland CHP Incentive." January 15, 2009. <http://webapp.psc.state.md.us/Intranet/CaseNum/submit.cfm?DirPath=\\Coldfusion\EWorkingGroups\DRDG\\9149%20Distributed%20Generation%20Working%20Group&CaseN=Demand%20Response/Distributed%20Generation%20Working%20Group>.

Adopt New Regulations and Policies

The MEA should collaborate with other Maryland agencies to adopt new regulations and policies that encourage the deployment of clean DG. Although Maryland already has an interconnection standard in place, the MEA should work with the Maryland PSC to increase the size range of generators that are covered by the interconnection rules. The MEA should also work with the Maryland Department of the Environment (MDE) to institute output-based regulations that will encourage clean DG technologies. Furthermore, the MEA and PSC could strive to revise Maryland's RPS to include CHP as an eligible technology.

Explore the Feasibility of Large-Scale CHP Projects

Maryland should explore the feasibility of large-scale projects that utilize waste heat in existing and future electricity generating facilities. District energy systems are one practical way utilities and other entities can increase overall fuel utilization efficiency. The University of Maryland at College Park utilizes CHP to provide heating, cooling and electricity for the campus. Baltimore has a district heating and cooling system in the central business district (with a new expansion to Inner Harbor East) with 60% of its steam provided by a waste-to-energy plant.[78] The feasibility of such systems in other locations or the expansion of the Baltimore system should be studied. The State may also want to consider if it is justified and reasonable to establish a requirement that all new fossil-fueled baseload generation facilities in Maryland utilize their waste heat.

Establish Financial Incentives

Maryland already has financial incentives for distributed renewable generation. The State should consider establishing new financial incentives specifically for CHP deployment. New Jersey's CHP grants could be used as a model[79] by providing a rebate for each kW of capacity installed in CHP facilities.

Advance CHP Education and Outreach

While many Marylanders are aware of the positive impacts of renewable energy, the benefits of CHP are not easily recognized. Advancing education and outreach on CHP across all sectors is an important initiative. The MEA should first focus on industrial/manufacturing facility managers. One approach is for Maryland to sponsor training seminars to educate these managers on CHP and why they should choose to install units at their facilities. Then, MEA can focus on the public sector through more aggressive public awareness campaigns, energy audits, and technical training at industrial, commercial, and institutional sites, utilizing engineering students and other technically trained staff from the U.S. Department of Energy Mid-Atlantic Clean Energy Application Center.

How Will CHP Initiatives Help Achieve Maryland Goals?

The inherent fuel efficiency of CHP systems makes them an important part of achieving the EmPOWER Maryland goals. CHP is efficient and most new CHP, if fueled by natural gas or biomass, also has the potential to reduce greenhouse gas emissions if it replaces electricity from the grid. In addition to energy efficiency benefits, the additional generating capacity provided by CHP systems can help utilities meet their load during times of peak demand.

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[78] http://www.veoliaenergyna.com/en/veolia-energy-north-america/locations/baltimore.htm

[79] U.S. Environmental Protection Agency. Combined Heat and Power Partnership. "Funding Resources – NJ CHP Grants." September 18, 2009. <http://www.epa.gov/chp/funding/funding/newnjchpgrants.html>.

According to the Maryland DNR, approximately 3,700 sites in Maryland have the technical potential – potential maximum penetration rate without regard to economic feasibility – to utilize CHP. ACEEE estimates that the technical potential of CHP in Maryland is approximately 4,000 MW, of which ACEEE estimates the economic – or economically justifiable – potential to be 291 MW. ACEEE projects that, if implemented, the 291 MW CHP capacity could save 18.9 trillion Btu/year in fuel consumption, which equals 1.3% of all Maryland energy consumption in 2007. The same CHP capacity could produce approximately 2,000 GWh of electricity per year, an amount equal to 4.0% of all electric generation in Maryland in 2007.[80]

What are the Advantages and Disadvantages of CHP Initiatives?

Advantages include:

- *Efficiency Benefits* - The inherent fuel efficiency of CHP requires less fuel to produce a given energy output and the onsite location of CHP avoids transmission and distribution losses.
- *Environmental Benefits* - CHP can play a large role in reducing the environmental impact of power generation. Because less fuel is burned to produce each unit of energy output, CHP reduces air pollution and greenhouse gas emissions. Most new CHP, if fueled by natural gas or particularly biofuels, has the potential to reduce greenhouse gas emissions if it replaces electricity from the grid.
- *Reliability Benefits* - CHP can be designed to provide high-quality electricity and thermal energy to a site regardless of what might occur on the grid. This decreases the impact of outages and improves power quality.

Disadvantages include:

- Additional State appropriations are needed to establish financial incentives for CHP. Given the State's fiscal situation, this could be a major challenge.
- Larger CHP projects, such as district heating, require a long-term commitment that does not often fit with the current focus on short-term returns on investment.
- Projected relatively high natural gas prices over the next two decades,[81] and price volatility, can make CHP an economically unattractive option despite strong incentives.

3.4 Recommendations

[80] ACEEE, Energy Efficiency: The First Fuel for a Clean Energy Future, page 32.
[81] EIA, Annual Energy Outlook 2009, Natural Gas Demand, http://www.eia.doe.gov/oiaf/aeo/gas.html

4.0 Options to Advance Renewables to Meet Maryland's Renewable Portfolio Standard (RPS)

Maryland is blessed with rich renewable resources and a business climate that is poised to advance solar, wind, biofuels, and waste-to-energy opportunities that will contribute to the State's clean, reliable, and affordable energy economy. This chapter explores policy and program options to promote renewable energy resources and achieve Maryland's Renewable Portfolio Standard (RPS) goal of 20% renewables by 2022.

4.1 What is Maryland Currently Doing?

The State of Maryland currently offers incentives for private citizens, businesses, and industries to take advantage of solar, wind, biomass, landfill methane, geothermal, ocean, fuel cell, and hydropower resources. They include:

- *Clean energy production tax credits* for wind, geothermal, solar, hydropower, small irrigation, and municipal solid waste projects
- *Sales tax* waiver for renewable energy equipment
- *Property tax exemption* for solar and wind energy systems
- *Wind energy grants* up to $20,000 and a free wind anemometer loan program
- *Solar energy grants* for residential and small commercial photovoltaic (PV) systems of up to $10,000, residential and small commercial solar water heating systems of up to $3,000, and commercial mid-size solar arrays of up to $25,000
- *Geothermal heat pump grants* of up to $3,000

These incentives have been designed to help achieve the Maryland Renewable Portfolio Standard (RPS). In 2008, the Maryland General Assembly strengthened the State's RPS to provide a market-based incentive for new renewable generation. The Maryland RPS requires Maryland electric suppliers to provide their customers with gradually increasing portion of their electricity from renewable energy. This obligation is met through retirement of Tier 1 and Tier 2 Renewable Energy Credits, or RECs,[82] or through an alternative compliance fees paid into the Maryland's Strategic Energy Investment Fund (SEIF) to support renewable energy projects in Maryland.

[82] One renewable energy credits (REC) is equal to the renewable attribute associated with one megawatt-hour (MWh) of electricity from an accredited renewable source.

Tier 1 sources include: solar, wind, qualifying biomass, landfill methane, geothermal, ocean, certain fuel cells, energy derived from poultry litter, and small hydropower stations. Tier 2 sources include: hydroelectric (larger than 30 MW) and waste-to-energy plants, but are only eligible to meet the source requirement through 2018. Exhibit 4.1 provides details on the timing of the Tier 1 requirements, including a "solar carve-out," which begins at 0.005% in 2008 and ramps up to 2% in 2022, and the sunset of the Tier 2 requirements after 2018.

Exhibit 4.1: RPS Tier Requirements

Year	RPS Goals		
	Tier 1 (%)	Tier 1 Solar (%)	Tier 2 (%)
2007	1	N/A	2.5
2008	2.005	0.005	2.5
2009	2.01	0.01	2.5
2010	3.025	0.025	2.5
2011	5.0	0.04	2.5
2012	6.5	0.06	2.5
2013	8.2	0.10	2.5
2014	10.3	0.15	2.5
2015	11.5	0.25	2.5
2016	12.7	0.35	2.5
2017	13.1	0.55	2.5
2018	15.8	0.90	2.5
2019	17.4	1.20	0
2020	18.0	1.50	0
2021	18.7	1.85	0
2022	20.0	2.00	0

Source: Maryland PSC, *Renewable Energy Portfolio Standard Report of 2009, with data for Compliance Year 2007*, February 2009, page 11.

Clean Energy Production Tax Credits

The *Clean Energy Incentive Tax Credit*, enacted in 2006, offers a state income tax credit of 0.85 cents per kWh for electricity generated from qualified renewable sources, including wind, geothermal energy, solar energy, hydropower, small irrigation power, and municipal solid waste.

Tax Exemptions

Maryland waives its sales tax on solar, wind, and geothermal heat pump systems. Maryland also provides a 100% property tax exemption for residential solar and wind energy systems.

Renewable Energy Grants

The Maryland Strategic Energy Investment Fund (SEIF) [83] offers a number of grants to support renewable energy development. Grants are offered for residential solar water heating and photovoltaic (PV) systems, up to $3,000 and $10,000, respectively, to residential and commercial customers. MEA is also offering businesses grants of up to $25,000 for larger solar arrays.

MEA administers the *Windswept* grant program, which supports the deployment of wind energy systems for small commercial and residential customers. Private and federal funds are leveraged with grants up to $20,000 in value to offset between 10% and 30% of installation costs. Grant values depend on turbine size and performance. In addition, MEA, in conjunction Maryland Environmental Service, loans wind measurement anemometers to Maryland landowners.

Geothermal heat pump grants of up to $3,000 are also provided to Maryland citizens.

Local Government Support

MEA works with Maryland counties to promote renewable energy. Many counties offer their own financial incentives, including Anne Arundel, Harford, Howard, Montgomery, and Prince

[83] MEA, Regional Greenhouse Gas Initiative (RGGI) information, http://www.energy.state.md.us/rggi.asp

George's.[84] In particular, MEA supports county officials and community wind energy entrepreneurs in the development of community-scale projects, both through the State's regulatory processes for permitting new generation and through local planning and zoning procedures for small wind energy systems.

Renewable Energy Analysis and Advancement

MEA, the State of Maryland Department of General Services, and the University of Maryland have collectively launched the *Generating Clean Horizons* initiative to make a larger impact on the amount of installed clean energy in Maryland. An RFP has been issued to attract companies interested in providing clean energy generation under a power purchase agreement with the State. Results are expected before the end of 2009. This initiative supports the efforts of the Maryland Public Service Commission (PSC), which is considering new in-state generation from both renewable and conventional sources. Specifically, new generation potential and opportunities are the focus of PSC *Case Number 9117* [85] and *Report SB 400* to the General Assembly [86] and *Case Number 9124*, opened in September 2009.[87]

In an effort to advance biomass development, several Maryland entities—MEA, Maryland Environmental Services, and Salisbury State University—are conducting a cellulosic feedstock study to assess biomass source locations and the potential costs of moving feedstocks to sites around the State.[88]

The State of Maryland provides technical support to both developers and other State agencies in planning and pre-construction analysis for renewable energy projects. Earlier this year, the State of Maryland released a *Request for Expressions of Interest and Information* from wind energy developers interested in constructing wind energy generation facilities in ocean areas adjacent to Maryland's coast. MEA is also completing a Memorandum of Understanding (MOU) with the Department of Natural Resources (DNR) on marine spatial planning.

In addition, through a contract with the Maryland Department of Natural Resources (DNR), the Nature Conservancy is compiling a detailed report on the characteristics of Maryland's coastal waters and adjacent federal Outer Continental Shelf areas and creating a decision support tool to help facilitate project and policy evaluations. MEA is also developing a strategy for incorporating additional data layers into the Coastal Atlas program (e.g., wind speed, PJM interconnection options, and radar and Federal Aviation Administration restrictions.) Finally, MEA is working collaboratively with the neighboring states of Delaware and Virginia to determine best practices and resources related to offshore wind.[89]

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[84] For additional information on state incentives for renewable energy in Maryland, visit www.energy.state.md.us

[85] PSC Case 9117, *Commission's Investigation of Investor-owned Electric Companies' Standard Offer Service for Residential and Small Commercial Customers in Maryland*

[86] PSC Report, *Reregulation and New Generation,* in response to Maryland Senate Bill 400, December 10, 2008.

[87] PSC Case 9124, Constellation Energy Group, Inc. proposes to refurbish and reactivate Unit 3 at Gould Street plant in Baltimore, potentially adding 100 MW of gas-fired generation.

[88] State of Maryland, Governor's Delivery Unit, *GDU X: Increase Renewable Energy Portfolio by 20% RPS by 2022*, October 2009, page 6.

[89] Office of Governor O'Malley, press release, November 10, 2009, http://www.gov.state.md.us/pressreleases/091110.asp.

4.2 What Are the Results So Far?

As described in Chapter 2, Maryland is just beginning to show progress in fulfilling the State's RPS mandate. This is primarily due to the 2008 legislative changes in Maryland's RPS requirement, which do not become effective until 2011. Nevertheless, Maryland's RPS obligations through 2007 (latest data available) have been satisfied through submission of the appropriate level of Tier 1 and Tier 2 RECs, or through alternative compliance payments (ACPs). In 2008, ACPs generated over $1 million, mostly to comply with the solar carve-out provisions.

Maryland's *Clean Energy Production Tax Credit* offers up to $25 million in incentives for projects that begin producing energy by December 31, 2010. To date, MEA has certified approximately $5.1 million out of the $25 million.[90] However, several of these projects have been delayed due to the economic downturn, among other factors, making it unclear whether they will be able to meet the required qualifications.

The response to other MEA-administered financial incentives has been remarkable. The *Solar Energy Grant Program* reports that grants for PV installations increased from 80 in FY2008 to 208 in FY2009 to over 550 projected in FY2010. Solar water heating grants also increased from 98 to 140 during the same period, with over 225 projected in FY2010.

Installed renewable energy capacity as a result of MEA's *Renewable Energy Grant Program* is shown in Exhibit 4.2. The number of households served by the program is provided in Exhibit 4.3

Exhibit 4.2: MEA Renewable Energy Grant Program Installed Capacity (kW)

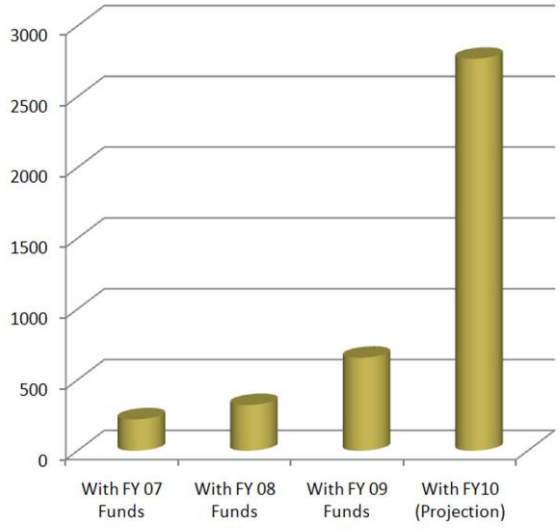
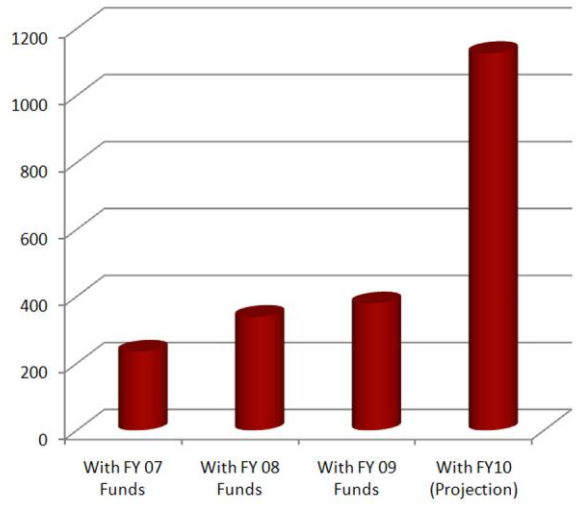


Exhibit 4.3: Number of Households Served by MEA Renewable Energy Grant Program



Due to soaring demand, MEA has modified its grant program and award sizes in an effort to stretch the funds, expand the number of Maryland families receiving awards, and increase the amount of kilowatts generated per dollar spent.

[90] MEA

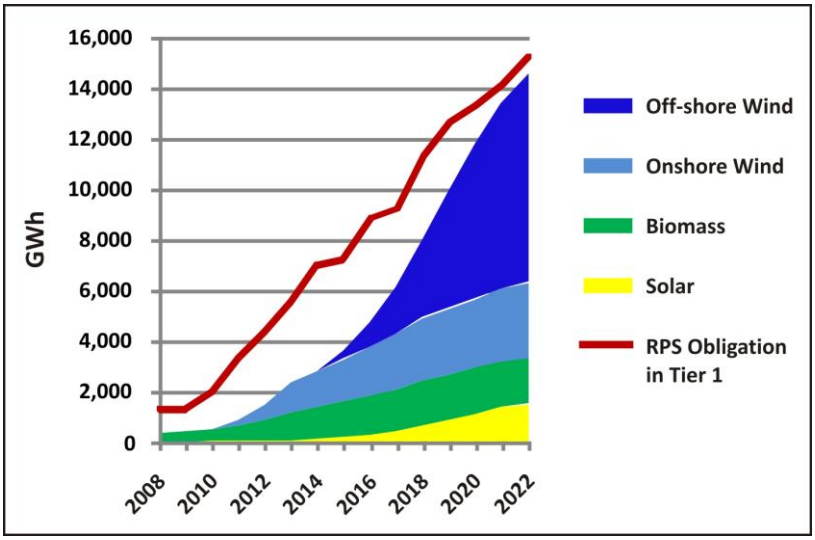
The MEA-administered *Windswept* grant program has resulted in 224 kW of deployed capacity in FY2009. In FY2010, MEA intends to increase deployment to 400 kW. As for community-scale projects, approximately 30 MW (name-plate) are in the early stages of development.[91]

There are 230 MW of commercial in-state wind projects in the PJM queue that are in various stages of approval by the Maryland PSC. The projects range in size from 40 to 70 MW and are located in western counties in the state. Several projects have been granted Certification of Public Convenience and Necessity (CPCN) Exemption and are proceeding toward construction.[92]

4. 3 What More Can We Do?

While progress has been made to meet the RPS requirements, additional actions can be taken today to help Maryland fulfill its important mandate by 2022 and beyond. To meet a significant portion of its RPS goals through in-state renewable generation, new renewable sources such as land-based and offshore wind must be developed in Maryland. Exhibit 4.4 shows that the RPS can be adjusted to reflect changing market conditions as well as our increased understanding of what is working in other states. Implementing a strategy with a supportive policy framework will enable appropriate technologies and levels of deployment to meet the RPS schedule.

Exhibit 4.4: Potential Scenario for Fulfilling Maryland RPS Tier 1 Requirement



Sources: Maryland PSC, Load Projection - Net DSM; Governor's Delivery Unit, GDU X; PPRP, The Potential for Biomass Co-firing in Maryland

Stabilizing financial incentives for renewable resources would provide the much needed assurance required to sustain investment and growth in this industry in the State. Maryland could also learn from other states' experiences with renewable energy financial incentives. To further support the development of in-state renewable energy resources, policies and incentives could be modified to be more attractive to both in-state and out-of-state developers.

There are many additional policies or policy modifications that Maryland can pursue to encourage renewable energy development. In the process of preparing the *Maryland Energy Outlook*, numerous such options were considered and discussed with State agencies and renewable energy developers, including: adjusting the RPS implementation schedule; designating specific technology obligations or

[91] MEA

[92] Maryland PSC, *Annual Report on the Status of Wind-Powered Generating Stations in the State of Maryland*, February 1, 2009, and updates on individual cases.

"carve-outs" in the RPS; adjusting the Alternative Compliance Payment penalty; changing the structure of current incentive programs; and implementing new tax incentives and grant programs.

Based on policies and programs that already exist and best practices in other states, the following options were selected for further analysis. These options are:

- Modify the RPS Solar Requirement
  - Accelerate phase-in of solar RPS requirement
  - Adjust Alternative Compliance Payment penalty to encourage new solar installations
- Extend the waste-to-energy RPS requirement
- Establish a carve-out for ocean energy in the RPS
- Extend and expand Maryland's Renewable Energy Production Tax Credit program

4.3.1 Modify the RPS Solar Requirement

Refinements to Maryland's RPS solar requirement could be made to ensure that the implementation schedule is balanced and reasonable over its lifetime and that it is more effective in promoting installation of solar energy systems, as follows:

- Currently, solar installation requirements are relatively modest in the early years, compared to later years. The solar requirement schedule could be accelerated in those early years. This would make the phase-in of the requirement more evenly distributed over the RPS lifetime and reiterate the importance of solar technology and its environmental and employment benefits. This modification would also provide more long-term support for Maryland's growing solar industry.
- The Alternative Compliance Payment (ACP), which is a fee that must be paid if an electricity provider fails to meet the solar component of Maryland's RPS, could be adjusted. Currently, the ACP is set to decrease substantially over the next dozen years. The ACP's decreasing value has the immediate impact of discounting the long term value of solar REC credits, which may undermine the financial incentive to invest in solar today. The ACP could be modified to a higher level, thereby encouraging utilities to pursue the development of actual solar installations rather than choosing to pay the ACP.

What is Maryland's Experience with the RPS Solar Requirement?

Maryland's RPS requires that a specific percentage of electricity sold in the State must come from solar energy. The solar requirement starts with 0.005% in 2008 and increases each year, peaking at 2% in 2022 and remaining at 2% for each year thereafter. Solar electricity generating facilities must be sited in Maryland beginning on January 1, 2012, to meet the solar requirement. Exhibit 4.5 shows the solar set-aside requirements of the Maryland RPS and an estimate of solar PV capacity that would be required to achieve these targets.

As of August 2009, cumulative PV installed capacity in Maryland is approximately 2.9 MW.[93] This is well short of the 5.5 MW cumulative installed capacity needed to meet the solar RPS requirement

[93] 2.9 MW figure based on PSC data and MEA data on behind-the-meter installations.

of 0.01% for 2009. In order to meet Maryland's 0.9 % solar goal by 2018, installed capacity would need to be approximately 548 MW.

MEA is aware of well over 50 MW of new commercial scale solar projects currently in various stages of development. While many of these projects may not ultimately come online, the level of interest in large scale solar projects is at an all-time high. Since Maryland's RPS only requires 22.5 MW of solar RECs (S-RECs) in 2011, an argument can be made that the slow ramp up may inadvertently serve as a ceiling, inhibiting faster growth in the commercial solar market.

Exhibit 4.5: Progress in Meeting the Solar RPS Goal

Year	MD Retail Sales		Solar RPS		MW/Year Installed		
	Solar %	GWh*	Estimated MWh	Needed MW	Needed Solar Addition	Actual Solar Added**	Actual Solar Cum**
Prior						0.036	0.036
2006						0.033	0.069
2007						0.116	0.185
2008	0.005%	64,701	3,235	2.7	2.7	1.436	1.621
2009	0.010%	65,116	6,512	5.5	2.8	1.279	2.900
2010	0.025%	65,631	16,408	13.9	8.4		
2011	0.040%	66,360	26,544	22.5	8.6		
2012	0.060%	67,233	40,340	34.1	11.7		
2013	0.100%	67,694	67,694	57.3	23.1		
2014	0.150%	68,221	102,332	86.6	29.3		
2015	0.250%	68,872	172,180	145.7	59.1		
2016	0.350%	69,936	244,776	207.1	61.4		
2017	0.550%	70,925	390,088	330.0	122.9		
2018	0.900%	71,982	647,838	548.1	218.1		
2019	1.200%	73,076	876,912	741.9	193.8		
2020	1.500%	74,211	1,113,165	941.8	199.9		
2021	1.850%	75,249	1,392,107	1177.8	236.0		
2022	2.000%	76,394	1,527,880	1292.6	114.9		

* Maryland PSC, *PSC Sales Projection - Net DSM*, February 2009
** Source: Maryland PSC, *Renewable Energy Portfolio Standard Report of 2009;* 2009 solar addition estimate based on extrapolation of MEA mid-year data

The compliance fee schedule for the solar RPS was $450/MWh in 2008 and adjusted to $400 in 2009, and will decrease $50 every 2 years until it levels out at $50 by 2022.[94] The decreasing ACP schedule limits the financial return from the sale of S-RECS to investors in the utility scale systems. In addition, an increased S-REC value potentially provides additional revenue for Maryland's residents who have solar systems installed and can offset the grants that are currently being offered, but with grant funds expected to diminish in the coming few years.

[94] PSC Article §7-704.

As described above, Maryland provides a wide array of incentives to encourage solar energy development, including grants for residential and commercial projects, production tax credits for commercial installations, and a State sales tax exemption for renewable energy equipment. Additionally, some counties offer property tax exemptions. During 2008-2009, MEA awarded $8.4 million in grants for solar systems; of these grants, 288 were for solar PV. The *Maryland Solar Grants Program* incentive levels are tiered to favor smaller residential installations, and program eligibility is limited to systems under 20 kW. Maryland solar project developers can receive supplementary federal incentives as well.[95]

Maryland has both the solar resources and the infrastructure to significantly build its solar industry. We are fortunate to be home to a number of solar component manufacturers, equipment installers, and servicing and design firms. Among the leaders is BP Solar, located in Frederick, which not only manufactures PV panels, but offers utility scale financing. One of the most prominent solar project developers and financiers in the nation, SunEdison, is headquartered in Beltsville. The regional Solar Energy Industry Association (SEIA) lists over 80 professional and corporate members in Maryland, many of whom provide necessary support to residential, commercial, industrial, and institutional solar installations. We have the capability to meet the full solar supply chain; the Maryland RPS and our existing State incentives are critically important to success in this endeavor.

What Are Other States' Experiences Regarding RPS Solar Requirements?

As of October 2009, 15 states have a solar carve-out as part of their RPS. Among them, New Mexico has the highest solar target, 4% of electricity sales by 2020. Other states with high solar targets are New Jersey (2.12% by 2021), Delaware (2.005% by 2019), and Maryland (2% by 2022). Solar RPS allocations in Maryland and selected nearby states are summarized in Exhibit 4.6.

[95] MEA, http://energy.maryland.gov/incentives/residential/solargrants/index.asp

Exhibit 4.6: Solar Carve-Outs in Maryland and Selected Nearby States

State	Carve-Out	Target Date	Phase-In Schedule	Alternative Compliance Payments	Grid connected capacity 2008 (kW_{dc})
DE	2.005%	2019	2010: 0.018% 2012: 0.099% 2015: 0.559% 2018: 1.547%	Begins at $250/MWh and increases to $300 if the electricity supplier has opted for the ACP in any previous year; increases to $350 with subsequent uses.	1,824 kW_{dc}
D.C.	0.4%	2020	2010: 0.028% 2012: 0.070% 2015: 0.170% 2018: 0.30%	$500/MWh	661kW_{dc}
MD	2%	2022	2010: 0.025% 2012: 0.060% 2015: 0.250% 2018: 0.900%	Starts at $450/MWh in 2008 and decreases $50 every two years until 2023; $50/ MWh 2023 and thereafter.	3,129 kW_{dc}
NJ	2.12%	2021	2010: 0.221% 2012: 0.394% 2015: 0.765% 2018: 1.333%	2008-2009: $711/MWh; 2009-2010: $693; 2010-2011: $675; 2011-2012: $658; 2012-2013: $641; 2013-2014: $625; 2014-2015: $609; and 2015-2016: $594	70,236 kW_{dc}
NC	0.2%	2018	2010: 0.02% 2012: 0.07% 2015: 0.14% 2018: 0.20%	No penalties for noncompliance.	4,697 kW_{dc}
OH	0.5%	2024	2010: 0.01% 2012: 0.06% 2015: 0.15% 2018: 0.26%	$450/MWh in 2009, reduced to $400/MWh in 2010 and 2011, and will be reduced by $50 every two years thereafter to $50/MWh in 2024.	1,356 kW_{dc}
PA	0.5%	2020	2010: 0.0120% 2012: 0.0325% 2015: 0.1440% 2018: 0.3400%	Set at "200% of average market value" of the solar credits sold during the reporting period.	3,938 kW_{dc}

Sources: DSIRE, http://www.dsireusa.org/; National Renewable Energy Laboratory (NREL), *State of the States 2009: Renewable Energy Development and the Role of Policy*, October 2009; and NREL estimate of Maryland solar capacity (which differs from Maryland PSC figures provided in Exhibit 4.3)

When comparing the phase-in schedules of the three states in the region with the most aggressive solar goals–New Jersey, Delaware, and Maryland–it is apparent that Maryland's requirement is the most "back-loaded." Compared to New Jersey and Delaware, Maryland's solar requirement increases more slowly in the early years of the RPS, and then increases more rapidly in the last few years. In 2015 the solar requirement in Maryland is only 0.25% of electricity sales, while it is 0.765% in New Jersey and 0.559% in Delaware.

In the early years of the allocation requirement, even some states with much lower overall solar targets, such as the District of Columbia, North Carolina and Ohio, have interim targets that are equal to or exceed those in Maryland. Maryland's back-loaded RPS schedule imposes very high annual installation requirements during the latter years of the RPS. These significant allocations may be difficult to achieve.

Maryland's alternative compliance payments (ACPs) differ markedly from those in New Jersey and Delaware. New Jersey has the highest compliance payments in the region, starting at $711per MWh

in 2009 and declining to $594 by 2016. Delaware's compliance payment of $250 per MWh does not decline over time, but higher payments (i.e. with multipliers) are required of utilities that choose to pay compliance payments in two or more consecutive years. The District of Columbia also has a constant, and higher ($500/MWh), compliance payment. In Pennsylvania, compliance payments are set at twice the value of solar RECs during the compliance period.

It is clear that aggressive solar requirements and high ACPs, combined with federal and State incentives, have contributed to robust growth in solar installations in New Jersey. At the end of 2008, installed solar capacity in the State was 70.2 MW, second only to California.[96] This growth is expected to continue, as evidenced by the announcement in July 2009 by a large utility based in the State, announcing plans to add 80 MW of solar capacity in its territory by the end of 2013, through installation of 200,000 small PV panels on existing power poles.[97]

Will Modifying the Solar RPS Help Achieve Maryland Goals?

Maryland's current RPS policy establishes an aggressive, but achievable, solar energy target for the State. By modifying the phase-in schedule of the solar RPS and adjusting ACP levels, it is more likely that the goals of the solar carve-out will be achieved and that the number of actual solar installations will grow in Maryland. In turn, more solar installations will help achieve **all four** of Maryland's energy goals:

- **EmPOWER Maryland:** Because electricity produced by solar PV coincides with peak cooling loads from air conditioning, it provides an effective peak load reduction technology and contributes to decreasing peak electricity prices.
- **Maryland RPS:** Solar energy installations increase the amount of renewable energy production.
- **GHG Reduction:** Solar energy reduces GHG emissions by displacing fossil-fueled power generation.
- **Green Jobs:** Maryland is home to two major solar companies, BP Solar and Sun Edison, and dozens of installers and service firms. Growth in solar installations is likely to lead to increased business for these and other local businesses, creating new jobs in Maryland.

What are the Advantages and Disadvantages of Modifying the RPS Solar Requirement?

Advantages include:

- More effective incentives will result in increased solar development, following the pattern seen in New Jersey. More development adds much needed electricity onto Maryland's grid, helps diversify the State's energy portfolio, and serves as a hedge against future fossil fuel price increases in coming decades.
- Increasing Alternative Compliance Payments is a relatively minor change in existing policy.
- A more evenly distributed compliance schedule will result in more achievable solar goals during the later years.
- All customers receive the environmental benefits of reduced GHGs from solar energy.

[96] National Renewable Energy Laboratory (NREL), State of the States 2009: Renewable Energy Development and the Role of Policy, October 2009, page 35.
[97] PSE&G Press Release, July 29, 2009, http://www.pseg.com/media_center/pressreleases/articles/2009/2009-07-29.jsp#

- Growth in solar installations is likely to lead to increased market opportunities for existing and new Maryland-based solar energy companies, benefiting the State's economy.
- General benefits from greater use of solar include:
  - Coincides with peak cooling loads, providing an effective peak load reduction strategy;
  - Provides electricity at point of use, reducing transmission losses
  - Provides long term power price stability

Disadvantages include:

- Increasing the solar ACP may lead to slightly higher electricity prices, although the solar requirement is only a small portion of all utility sales, significantly dampening the potential price impact on the utilities and thereby sheltering consumers.
- Rapid growth in solar system demand may create other supply chain constraints, including shortage of trained installation professionals.
- Despite generous State and federal incentives, high upfront cost of solar systems continues to make them uncompetitive for many consumers.

4.3.2 Extend the Waste-to-Energy RPS Requirement

What are the Suggested Modifications to the Waste-to-Energy Requirement in the RPS?

Technologies in Tier 2 of the RPS include waste-to-energy (WTE) and certain hydroelectric facilities. Currently, the 2.5% Tier 2 requirement drops to 0% in 2019 and beyond. The State should consider amending the RPS statute in a manner that extends the WTE requirement beyond 2018. This could be achieved by making the Tier 2 requirement permanent, or by defining waste-to-energy technologies as a Tier 1 resource.

What is Maryland's Experience with the Waste-to-Energy Requirement in the RPS?

Several Maryland municipalities are served by WTE or so-called municipal solid waste (MSW) plants. As is typical nationwide, the steam produced by combusting solid waste at Maryland facilities is used to drive a turbine that generates electricity.[98] Total MSW plant capacity in Maryland increased from 138 MW in 2008 to 267.2 MW in 2009[99] at three facilities in Baltimore and in northeast Maryland. These plants produced 293 GWh of electricity, or approximately 17% of total renewable energy generation in Maryland in 2007.[100] The three currently certified Tier 2 MSW facilities are estimated to produce approximately 1,400 GWh annually.[101]

Two more WTE plants are awaiting approval. Frederick and Carroll Counties are jointly planning a 45 MW facility with a design capacity of 547,500 tons of waste per year that is expected to be online in the next several years. A proposed 120 MW WTE Project in Baltimore is being planned as part

[98] EPA, Waste-To-Energy, http://www.wte.org/environment/
[99] PSC, *Renewable Energy Portfolio Standard Report of 2009, with data for Compliance Year 2007,* February 2009, and yet to be published supplemental data in September 2009.
[100] PSC Ten-Year Plan, Renewable Projects Providing Capacity and Energy to Maryland, Table A-9, February 2009
[101] Ibid.; assumed 59% MSW plant capacity factor based on 60 MW Baltimore plant generation from PSC, Table A-9.

of an Eco-Industrial Park.[102] Military installations in the State are also considering construction of WTE facilities.

WTE facilities provide an attractive local energy resource for Maryland and could be cost-effective for consumers. Technology assessments and cost-benefit analyses should be pursued to determine how best to harness the inherent value of waste products. At the same time, air quality issues and opposition to WTE facilities in local communities may overshadow their positive attributes.

Thirty-one state-level RPS policies have binding targets, fourteen of which include WTE, or MSW, technologies as an eligible resource. In the other seventeen states, MSW cannot be used to meet the RPS requirements.[103]

Of the states that include MSW in their RPS, seven, including Maryland, limit WTE technologies to a portion of the total RPS requirement. In Maine, existing MSW facilities are eligible for the RPS, but new facilities are not. In Minnesota, a large carve-out for wind energy leaves only a relatively a small portion, or 5%, to other technologies, including MSW. Five states, including Connecticut, the District of Columbia, Maryland, Massachusetts, and New Jersey, categorize renewable technologies into "tiers" or "classes" and set separate targets for the different tiers. Details about these five state tiers that contain MSW are included in Exhibit 4.7.

Exhibit 4.7: States with RPS Tiers/Classes That Contain WTE/MSW

State	Tier/Class Technologies	Percentage	Tier Permanency
Connecticut	Waste-to-energy, certain biomass, certain hydro	3%	Permanent
District of Columbia	MSW, hydro	2.5% (2007-2015)	Phased out to 0% by 2020
Maryland	**Waste-to-energy, hydro**	**2.5% (2006-2018)**	**0% in 2019**
Massachusetts	MSW	3.5%	Permanent
New Jersey	Resource recovery, certain hydro	2.5%	Permanent

Source: DSIRE

Based on a review of the information contained in the DSIRE database, the Maryland and Washington D.C. tiers containing MSW are the only renewable energy resources or tiers in all the states with RPSs that are phased out over time. In all other states, resource requirements are permanent and do not decrease over time.[104]

[102] PSC Case 9199, Application filed along with requests for a waiver of the two-year notice requirement and expedited review of its Application, May 22, 2009.
[103] Based on analysis of RPS policy descriptions included on DSIRE website, http://www.dsireusa.org/, accessed October 20, 2009
[104] DSIRE, http://www.dsireusa.org/, accessed October 20, 2009

Will Extending the Waste-to-Energy Requirement in the RPS Help Achieve Maryland's Goals?

As the Maryland RPS statute currently stands, the 2.5% Tier 2 requirement, which includes WTE and large (larger than 30 MW) hydropower facilities, drops to 0% in 2019 and beyond. If Maryland decides to support continued development of WTE facilities, procurement requirements should extend beyond ten years. Extending the WTE requirement in Maryland's RPS would help the State achieve some of its long-term energy goals, as noted below.

- **Maryland RPS:** WTE facilities provide in-state renewable electricity generation that satisfies the RPS requirements.
- **GHG Reduction:** WTE technologies can contribute to GHG mitigation while generating significant ancillary benefits related to sustainable waste management. WTE facilities help mitigate methane (CH_4) which is released when some types of waste decompose. Waste minimization and recycling diverts waste from landfills, thereby reducing emissions released in combustion, transport and decomposition.
- **Green Jobs:** Extending the WTE requirement would provide a stable, long-term business environment that is favorable for green jobs.

What are the Advantages and Disadvantages of Extending the Waste-to-Energy RPS?

Advantages include:

- Secures a long-term revenue stream for WTE projects, which will increase their financial viability and ability to provide a valuable energy source in urban areas
- Employs an established technology that is widely used and accepted
- Reduces waste volume
- Produces GHG reduction benefits by reducing methane emissions
- Waste is a local resource, thus creating jobs and economic activity in Maryland

Disadvantages include:

- Difficulty of adding new WTE capacity in an EPA non-attainment region
- Community concerns regarding existing and new waste incinerators
- Disagreement among policy-makers on value of WTE as a renewable energy resource
- Environmental considerations associated with MSW, including production of atmospheric emissions, GHGs, and criteria pollutants, which require State regulatory attention

4.3.3 Establish a Carve-Out for Ocean Energy in the RPS

What is an RPS Carve-Out for Ocean Energy?

A specific RPS obligation for ocean energy – an ocean carve-out – encourages and incentivizes the development of ocean energy resources, such as offshore wind, energy from waves, energy derived from harnessing tidal flow, currents, and other renewable marine resources. Like the solar carve-out, an ocean energy carve-out would establish a set percentage of electricity sales in Maryland that needs to be satisfied through electricity generation from ocean energy resources.

As with other RPS carve-outs, policy makers would need to make other important policy decisions besides setting carve-out percentages and schedules. For example, can an ocean carve-out be satisfied with projects outside of Maryland, perhaps in the PJM Interconnection, or can it only be satisfied with projects located in Maryland waters? An ocean carve-out would also need to be backed by Alternative Compliance Payments (ACPs) that are set at a level high enough to ensure that actual projects are developed to meet the RPS requirement.

What Has Been Maryland's Experience Regarding Ocean Energy?

The State has not yet benefitted from ocean or off-shore wind energy projects. That may change, however, as a recently issued *Request for Information and Interest (RFI)* asking that project developers and others with an interest in such projects come forward. The RFI is "seeking to explore offshore wind energy resources to capture economic development, air quality, public health, greenhouse gas reduction and environmental benefits of domestic generation."[105]

Simultaneously, the State is conducting a study to evaluate opportunities for offshore wind energy on Maryland's Atlantic coast and Outer Continental Shelf. The study will assess the viability of offshore wind energy generation and build on important marine spatial planning work currently developed by DNR and The Nature Conservancy. The results of this study will give the State and potential wind energy partners significant guidance on the physical characteristics of Maryland's offshore resources.

In conjunction with these efforts, MEA is working with community leaders across the State to obtain early feedback on the potential for an offshore wind energy project. Maryland is considering multiple deployment strategies, including development of an initial technical evaluation staging ground as well as advanced large-capacity turbines and new methods of deep-water development. The State plans to draw on a broad range of capabilities and skills to evaluate opportunities for manufacturing and supply chain development, transmission management, and continued stakeholder outreach.

Besides wind, other ocean energy technology industries are becoming attracted to Maryland due to its long-standing scientific and business expertise in the marine field. Wavebob Ltd. is in the initial stages of exploring wave power technology in the U.S., and has recently opened an office in Annapolis. In addition, Underwater Electric Kite (UEK) Systems, a Maryland company also located in Annapolis, is exploring the potential for hydrokinetic energy.

What Are Other States' Experiences Regarding Ocean Energy?

Although no offshore wind projects have been built in the United States, several are in various stages of planning. In addition, kinetic hydro devices are being developed to exploit large potential energy resources in river and tidal currents. According to the DSIRE database, no state currently includes a carve-out for ocean energy or offshore wind in its RPS.[106] However, in March 2009, New

[105] Request for Expressions of Interest and Information Maryland's Offshore Wind Energy Deployment Strategy http://energy.maryland.gov/documents/OffShoreREoI91509.pdf
[106] DSIRE, http://www.dsireusa.org/, accessed October 20, 2009

Jersey's Office of Clean Energy released a strawman proposal to establish an offshore wind "carve-out" within New Jersey's Renewable Portfolio Standard; this proposal is currently under review.[107]

Carve-outs for other renewable energy resources are a common element in state RPS policies. Typically carve-outs are employed where there is a combination of a developing industry and good renewable energy resource potential. Of the 31 states with a binding RPS, 15 have a carve-out for solar energy. In addition, 14 states have included other types of carve-outs or set-asides in their RPS covering a wide range of different technologies and types of installations. Exhibit 4.8 includes a summary of the different types of carve-outs included in state RPS policies.

Exhibit 4.8: Summary of Carve-Outs in State RPS Policies

Description of Carve-Out	States
Solar	Colorado, Delaware, District of Columbia, Illinois, Maryland, Missouri, Nevada, New Hampshire, New Jersey, New Mexico, North Carolina, Ohio, Oregon, Pennsylvania, Rhode Island,
Wind	Illinois, Minnesota
Other resource-specific carve-outs	New Mexico, North Carolina
Customer-sited, distributed generation, or "community projects"	Arizona, Massachusetts, Montana, New Mexico, New York
For different priority tiers and classes (primarily to limit contribution from less preferred or existing resources)	Connecticut, Maryland, Massachusetts, New Hampshire, New Jersey

Source: DSIRE, http://www.dsireusa.org/

Because most state RPS policies are relatively new, sufficient information is not available to thoroughly evaluate their impact on renewable energy development. However, according to a study by Lawrence Berkeley National Laboratory (LBNL), RPS policies are widely considered to be among the most important policies leading to increased renewable energy capacity.[108] This conclusion is supported by the fact that among the states with the highest percentage of total electricity generated by non-hydroelectric renewables, nine of ten states have adopted mandatory RPS policies.[109]

It is also too early to conclusively evaluate the effectiveness of technology-specific carve-outs. However, ranked by the total number of distributed solar installations in 2008, three of the top four states have an RPS solar carve-out policy in place.[110] California is the only state among the top four

[107] New Jersey Board of Public Utilities, *REVISED Straw Proposal: New Jersey's Offshore Wind Renewable Energy Certificate (OREC),* March 10, 2009, http://www.njcleanenergy.com/files/file/Renewable_Programs/Wind/REVISED%20OREC%20Straw%20Proposal%20031009%20fnl.pdf

[108] Lawrence Berkeley National Laboratory, Renewable Portfolio Standards in the United States: A Status Report with Data through 2007, 2008

[109] National Renewable Energy Laboratory (NREL), State of the States 2009: Renewable Energy Development and the Role of Policy, October 2009, page 16

[110] Top four states: California, New Jersey, Colorado, Nevada. Source: NREL, State of the States 2009: Renewable Energy Development and the Role of Policy, October 2009, page 35

without a specific solar carve-out but it has aggressively supported solar development through other policies and incentives.

Nearby States' Current Activities

While no states include a carve-out for ocean energy or offshore wind in their RPS, several states along the Mid-Atlantic coastline are supporting related activities. Offshore wind efforts in New Jersey, Delaware, Virginia, and North Carolina are described below.

New Jersey

New Jersey has developed a very ambitious offshore wind program.[111] *New Jersey's Energy Master Plan* calls for a minimum of 1,000 MW of offshore wind capacity to be developed by 2013, and a minimum of 3,000 MW of offshore wind capacity by 2020.[112] A strawman proposal to establish an offshore wind carve-out within New Jersey's RPS is currently under consideration;[113] the proposed schedule and requirements are shown in Exhibit 4.9.

Exhibit 4.9: New Jersey Strawman Proposal for an Offshore Wind Carve-Out – Proposed Schedule and Requirements

Year	Offshore Carve-Out by Capacity (MW)	Offshore Carve-Out by Production @ 34% Capacity Factor (MWh)
2013	Total of 1,000 MW	2,978,400
2017	At least 2,000 MW	5,956,800
2021	Total of 3,000 MW	8,935,200

Source: New Jersey Board of Public Utilities, *REVISED Strawman Proposal: New Jersey's Offshore Wind Renewable Energy Certificate (OREC),* March 10, 2009, page 4.
http://www.njcleanenergy.com/files/file/Renewable_Programs/Wind/REVISED%20OREC%20Straw%20Proposal%20031009%20fnl.pdf

As shown in this exhibit, the proposed New Jersey offshore wind carve-out is established as a production requirement expressed in MWhs versus a percentage of total load served. A 34% capacity factor is used for example purposes; the New Jersey Board of Public Utilities (NJBPU) would determine the appropriate capacity factor to be used for determination of the carve-out. The increments are designed to stimulate project development while allowing flexibility consistent with the scale and pace of offshore wind project development.

In June 2009, the NJBPU awarded $12 million in rebates to three offshore wind developers ($4 million to each developer), following award of a $4 million grant to a developer for the first offshore

[111] Miller, L., Chief of Policy and Planning, New Jersey Board of Public Utilities, "Wind: Nearby Resource," presentation at United States Capitol for Environmental and Energy Study Institute, July 17, 2009, http://www.eesi.org/071709_offshore.
[112] State of New Jersey, Office of the Governor Press Release, "Governor Corzine Lauds Release of Windpower Leases," June 23, 2009, http://www.state.nj.us/governor/news/news/2009/approved/20090623a.html.
[113] New Jersey Board of Public Utilities, Docket No. EXO8100930.

project in the State. These funds are being used to conduct studies and to prepare permit applications; the remainder will be paid based upon production of electricity.

Delaware

Delaware has long supported offshore wind energy resource and ocean acidification research.[114] In 2009, a grant of $1.4 million was approved to cost-share the construction and testing of a 2 MW turbine at a shoreline site in Delaware.[115] On October 19, 2009, University of Delaware and Gamesa Corporación Tecnológica finalized an agreement to install a utility-scale wind turbine at the university's Hugh R. Sharp Campus in Lewes, Delaware, in 2010. This turbine will serve as a pilot for use in the 200 MW project planned by Bluewater Wind, LLC that will deliver power to Delmarva Electric as an initial segment of a possible 600 MW offshore plant. The Delaware Public Service Commission has approved a power purchase agreement at a price of $117.10 per MWh and has granted a 350% REC credit for offshore wind facilities sited on or before May 31, 2017.[116]

Virginia

In 2007, the Virginia General Assembly authorized formation of the Virginia Coastal Energy Research Consortium (VCERC), a university, government, and industry consortium formed with initial funding from the Commonwealth with a total budget of $1.5 million. VCERC provides research and development funding for commercialization and implementation of wind, wave, and algal biomass energy.[117] Recent wind energy studies are focused on an offshore project site 12 nautical miles east of Virginia Beach that has total potential for 3,680 MW.

Will Establishing a Carve-Out for Ocean Energy Help Achieve Maryland's Goals?

Maryland's coastal waters and adjacent Outer Continental Shelf enjoy wind resources characterized as "outstanding" by the U.S. Department of Energy.[118] Offshore wind is a stronger and more consistent resource than on-shore wind. Maryland's offshore wind resources are located less than 100 km from high voltage transmission lines and major load centers.[119] Recent data compiled by the Atmospheric Physics Department at the University of Maryland, Baltimore, also indicate powerful winds in low level jets (LLJs) over the Bays in late afternoon and evenings during summer months, possibly increasing wind energy capacity value.[120]

The economic potential of offshore wind was evaluated by Levitan & Associates, Inc. for the Maryland PSC along with other renewable technologies. The Levitan report notes positive economic value added for land-based wind projects, but negative value for offshore wind. However,

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[114] Kempton, W., Director, Center for Carbon-free Power Integration; Professor, College of Earth, Ocean, and Environment, University of Delaware, "Transmission and Wind," presentation at United States Capitol for Environmental and Energy Study Institute, July 17, 2009 http://www.eesi.org/071709_offshore.

[115] FY 2009 U.S. DOE Budget Appropriations Earmark, Senate Report 110-416 – Energy and Water Development Appropriations Bill, 2009, with additional cost-shared funding from University of Delaware and from the turbine manufacturer Gamesa.

[116] Delaware PSC, approved the Purchased Power Agreement executed between Bluewater Wind LLC and Delmarva Power & Light Company, in PSC Docket No. 07-20, Order Number 7440 on September 3, 2008.

[117] Hagerman, George, Director of Virginia Coastal Energy Research Consortium (VCERC) and Research Associate Virginia Tech Advanced Research Institute, "Green Power Superhighways or Offshore Wind or Both?", presented presentation at United States Capitol for Environmental and Energy Study Institute, July 17, 2009 http://www.eesi.org/071709_offshore.,

[118] NREL U.S. Wind Map, http://www.windpoweringamerica.gov/pdfs/wind_maps/us_windmap.pdf

[119] NREL, Maryland 50 Meter (height) Wind Resource Map 1.1.2, January 15, 2003, http://www.windpoweringamerica.gov/maps_template.asp?stateab=md

[120] Sparling, Lynn, M. Weldegaber, "Tall Tower Wind Data," UMBC in cooperation with Maryland DNR, NREL, and PERI, beginning in fall 2009.

based on new wind data, capacity factors can be expected be 10-15% higher than the estimate of 22.5 % for offshore plants used in the Levitan analysis.[121] This increase in expected capacity factor indicates that offshore wind could supply 44-66% more energy than previously projected, significantly boosting the economic feasibility of this type of deployment.

Moreover, measurements on towers 80 to 120 m tall located along the bay shorelines in Maryland and Virginia are underway to assess the wind speeds at greater heights than are reflected in current models.[122] Newer offshore wind turbine towers are often deployed at greater hub heights than previous generations and these studies will provide data that could dramatically affect the potential economic value of this resource.

The development of Maryland's most abundant renewable energy resource, ocean energy, would help Maryland achieve several of its energy goals, as shown below.

- **Maryland RPS:** Ocean energy installations could significantly increase the amount of renewable energy production. If Maryland is to fulfill a large portion of its RPS through in-state generation, offshore wind energy and other ocean energy resources should be considered.
- **GHG Reductions:** Utilization of ocean energy resources reduces GHG emissions by displacing fossil-fueled power generation.
- **Green Jobs:** Growth in ocean energy will lead to increased business for Maryland's marine industry.

What are the Advantages and Disadvantages of Establishing a Carve-Out for Ocean Energy?

Advantages include:

- Taps a resource that could potentially supply a large portion of Maryland's electricity needs
- Offshore wind speeds are higher and steadier than land-based wind, since there are no obstacles to block the wind and cause turbulence.
- Maryland's coastal waters and adjacent federal Outer Continental Shelf areas represent energy resources which are close to major load centers.
- RPS requirement is a budget-neutral option for the State (unlike financial incentives).
- Offshore projects support marine industries.
- Large-scale utilization of ocean energy could significantly reduce GHG and other emissions from fossil fuel generation.
- Ocean energy R&D is garnering federal support and could benefit Maryland's research institutions.
- Ocean/wind energy development decreases nitrogen levels in the Chesapeake Bay from coal plant emissions, reducing algae blooms.
- Ocean energy provides an opportunity for regional cooperation with other Mid-Atlantic States.
- Provides Maryland significant economic development opportunities with wind turbine supply chain and assembly work and the potential to become a primary component manufacturer

[121] Levitan, *Analysis of Resources and Policy Options for Maryland's Energy Future*, Table 20, page 146, December 1, 2008.
[122] Ibid.

Disadvantages include:

- The need to combat harsh ocean environments and deploy new transmission increases installed costs for offshore wind compared to land-based wind energy. This makes offshore wind development more expensive than many conventional generation options, which may put upward pressure on electricity prices.
- While offshore wind development has taken place in other parts of the world, no major projects have been constructed in the U.S. Due to lack of experience, offshore wind is considered an unproven technology by some utilities and other energy developers.
- Besides offshore wind energy, no other large-scale ocean energy technologies are expected to be commercially viable in the near future.
- Environmental impacts, such as possible effects on birds, fish and other wildlife, need to be researched and compared to other power generating options.
- Environmental and aesthetic concerns may impact public acceptance for ocean energy.
- Since ocean waters are governed by numerous federal and state statutes, and provide critical environments for sea creatures, finding suitable sites for ocean energy projects can be challenging.
- If the carve-out is not geographically limited to Maryland, the set-aside may incent project development in other states.

4.3.4 Extend and Expand Maryland's Renewable Energy Production Tax Credit Program

What is an Extension and Modification of Maryland's Renewable Energy Production Tax Credit?

Maryland's *Clean Energy Incentive Tax Credit*, enacted in 2006, offers Marylanders an income tax credit for electricity generated by qualified resources of 0.85 cents per kWh, and 0.50 cents per kWh for electricity generated from co-firing a qualified resource with coal. These credits, also known as Maryland Clean Energy Production Tax Credits (PTC), can be claimed over a period of five years. However, under current law, credits will only be available for facilities that commence operation before January 1, 2011.

The following modifications to the tax credit program could be considered to make it a more effective policy tool to incent the construction of new renewable energy facilities in Maryland:

- Extend the tax credit program until 2022, to correspond with the State's RPS policy.
- Increase the per kWh incentive.
- Extend the payment period to ten years.
- Allow the tax credits to be transferable to other entities, to enable those with insufficient or no tax liability to utilize the incentive.
- Establish a minimum limit for tax credit payments, or minimum size for eligible projects, to reduce administrative costs.
- Instead of providing a tax credit over a number of years, restructure the incentive with an option for an upfront payment similar to the federal program. This would provide critically needed upfront capital for project developers.
- Depending on the extent of implemented program changes, appropriate adjustments to the cap on total available credits and per project payment limits should be considered.

What Actions Have We Taken Already Regarding Renewable Energy Production Tax Credits?

Under the *Maryland Clean Energy Incentive Act*, tax credits are available to individuals and corporations that build renewable energy facilities and generate electricity from them on or after January 1, 2006, and before January 1, 2011. Renewable energy facilities for electricity production include solar, wind, open and closed loop biomass, geothermal, small irrigation power, municipal solid waste, and hydropower.[123] Annual tax credits cannot exceed one fifth of the initial credit certificate issued by MEA.

In order to receive these credits, eligible participants apply for an Initial Credit Certificate from MEA, which issues certificates on a first-come, first-served basis. Under current law, the total number of Initial Credit Certificates may not exceed $25 million by 2010, with each Initial Credit Certificate limited to $2.5 million to any eligible taxpayer. Tax credits may be claimed over a 5-year period.[124] The statute does not currently specify a minimum floor for tax credit payments. The smallest tax credit certified to date is for $133 over a 5- year period, or $26.60 per year.[125]

As of September 16, 2009, MEA had received 13 applications for Tax Credit Certificates for a total of $5.1 million. In part due to the economic downturn, some applicants do not have a sufficient tax liability to use their certificates. In addition, project delays are impacting the ability of companies to meet production deadlines and MEA may have to cancel the certificates. These companies may resubmit their applications or request extensions.[126]

What Are Other States' Experiences Regarding Renewable Energy Production Tax Credits?

Ten states have renewable energy production tax credits similar to the Maryland incentive program. However, several of these tax credit programs are new programs with no existing track record, pilot projects, or are limited to smaller installations. Iowa, Minnesota, New Mexico, and Oklahoma have programs comparable to the Maryland *Clean Energy Production Tax Credit*.[127] The successful production tax credit programs in Iowa and Oklahoma are described in further detail below.

Iowa

In 2005, Iowa enacted legislation creating two production tax credit programs; renewable energy facilities may qualify for one of the two credits. The tax credits are available for a 10-year period, may be carried forward for a maximum of seven years, and are transferable.

Under the first program, a production tax credit of 1.5 cents per kWh is available for energy generated and sold by wind energy generators and other renewable energy facilities. The maximum total amount of wind generating capacity eligible for this credit is 330 MW. The maximum total eligibility for other renewable technologies is 20 MW. The intent of the tax credit program has been to support small, locally-owned projects by setting a per facility size limit of 2.5 MW and establishing other ownership qualifications. As of October 2009, active applications filed with the Iowa Utilities

[123] COMAR 14.2606.00, http://www.dsd.state.md.us/comar/SubtitleSearch.aspx?search=14.26.06.*.
[124] MEA, http://www.energy.state.md.us/incentives/allprograms/cep_taxcredit.asp.
[125] MEA.
[126] MEA, http://www.energy.state.md.us/incentives/allprograms/cep_taxcredit.asp.
[127] DSIRE, http://www.dsireusa.org/, accessed October 20, 2009

Board exceed the 20 MW maximum for other renewable technologies and the 330 MW maximum for wind.[128]

Under the second program, a production tax credit of 1.0 cent per kWh is available for electricity generated by eligible wind energy facilities. While there are no specific ownership criteria for individual projects, facilities must have a minimum nameplate capacity of at least 2 MW and a maximum capacity of 30 MW. Applications from schools, colleges, universities, and hospitals must have a minimum nameplate capacity of 750 kW. The maximum total amount of generating capacity eligible for the second program is 150 MW. As of October 2009, credits for 124.5 MW of capacity were available for this program.[129]

Iowa's total installed wind capacity of 3,053 MW (as of June 2009) ranks second among all states.[130] According to the Iowa Office of Energy Independence, these state-level production tax credits have been of vital importance in ensuring the construction of many locally-owned, small wind farm projects. In addition, the federal PTC has generally been enough to ensure the economic viability of most large-scale wind farms in the State. However, even with the federal PTC and Farm Bill renewable energy grants, many of the smaller farmer-owned wind energy projects needed the additional State PTC incentive to be economically viable.[131]

Oklahoma

Since 2003, Oklahoma has offered a Zero-Emissions Facilities Production Tax Credit, a state income tax credit for producers of electric power using renewable energy resources from a zero-emission facility located in-state. The zero-emission facility must have a rated production capacity of 1 MW or greater and electricity must be sold to an unrelated party. The amount of the credit varies between 0.25 and 0.75 cents per kWh, depending on when a facility is put in service and when the electricity is generated. The credit may be claimed for a 10-year period following the date the facility is placed in operation. Eligible renewable energy resources include wind, hydroelectric, solar, and geothermal energy. The tax credit is freely transferable at any time during the ten years following the qualified year. This includes transfers or sales from non-taxable entities to taxable entities and transfers or sales from one taxable entity to another.[132]

As of June 2009, Oklahoma had installed approximately 865 MW of wind energy capacity.[133] Between 2001 and 2007, growth in renewable energy generation in Oklahoma was fifth fastest among all states. Among states with no RPS policy in place, renewable energy generation growth was faster in Oklahoma than in any other state.[134] The State's excellent wind energy resource is a major factor in that growth. According to the Oklahoma Department of Commerce (ODC), besides a five-year property tax abatement, the Zero-Emissions Facilities Production Tax Credit has been the primary policy tool supporting the State's rapid wind energy deployment. While no detailed data on the Zero-Emissions Facilities Production Tax Credit allocations and expenditures

[128] Iowa Utilities Board, http://www.state.ia.us/government/com/util/energy/renewable_tax_credits.html
[129] Iowa Utilities Board, http://www.state.ia.us/government/com/util/energy/renewable_tax_credits.html
[130] American Wind Energy Association (AWEA), http://www.awea.org/projects/
[131] Lee Vannoy of Iowa Office of Energy Independence and Tom Wind of Wind Utility Consulting, several discussions 2006-2009.
[132] DSIRE, http://www.dsireusa.org/, accessed October 20, 2009.
[133] AWEA, http://www.awea.org/projects/
[134] National Renewable Energy Laboratory (NREL), *State of the States 2009: Renewable Energy Development and the Role of Policy*, October 2009, page 21.

are available, it is believed that all major wind projects in the State utilize the credit. No other renewable energy development, other than wind, is underway in Oklahoma.[135]

Will Extending and Modifying Renewable Energy Production Tax Credits Help Achieve Maryland's Goals?

An extended and modified PTC program would enhance the development of renewable energy generation in Maryland and help the State achieve several of its energy goals:

- **Maryland RPS:** A PTC supports the development of all renewable energy resources and larger renewable energy projects in particular. Maryland currently offers a wide array of financial incentives for smaller residential-scale renewable energy systems, but not as many incentives for larger utility-scale installations.
- **GHG Reductions:** Greater utilization of renewable energy resources reduces GHG emissions by displacing fossil-fueled power generation.
- **Green Jobs:** Development of in-state renewable energy projects will lead to increased business activity and more jobs in Maryland.

What are the Advantages and Disadvantages of Extending the Renewable Energy Production Tax Credits?

Advantages include:

- Supports development of all renewable resources
- Encourages both small and large scale projects
- Supports projects based on the actual amount of electricity produced
- Builds on an existing program
- Can be implemented with relatively minor administrative actions
- Does not require State budget expenditures
- Program expenditure caps limit the State's exposure to tax revenue losses.

Disadvantages include:

- Reduces future tax revenue
- Unclear what incentive level is needed to encourage the construction of new renewable energy facilities
- Different technologies may require different levels of tax credits for projects to be economically viable.
- Increasing PTC per kWh payments and extending the payment period to 10 years may create pressure to increase program expenditure limits, which may be difficult to do under current fiscal constraints.

4.4 Recommendations

[135] Oklahoma Department of Commerce, Kylah McNabb, phone conversation October 22, 2009.

5.0 Options for Advancing Clean Energy Economic Development and Green Jobs in Maryland

This chapter explores policy and program options to promote clean energy economic development and green jobs in Maryland.

5.1 What is Maryland Currently Doing?

Governor O'Malley has positioned Maryland as one of the most progressive clean energy states in the nation. In 2008, the General Assembly enacted three legislative initiatives: the *EmPOWER Maryland Energy Efficiency Act of 2008,* which sets energy conservation and peak demand goals by 2015; revisions to the *Renewable Portfolio Standard* that sets a 20% goal for renewable energy by 2022; and the *Greenhouse Gas Reduction Act,* which requires the Maryland Department of the Environment to have a plan in place to reduce greenhouse gas emissions by 25% by 2020. These initiatives create significant demand for clean energy technologies in Maryland and serve as a foundation upon which to build the Administration's *Smart, Green and Growing Maryland* program. A strategic plan to take advantage of the opportunities presented by these initiatives is needed to benefit Maryland's workforce and citizens.

In its September 2009 report on Maryland's energy industry workforce, the Governor's Workforce Investment Board (GWIB) defined Maryland's "green economy" as "the system of production, exchange, distribution and consumption of goods and services produced by any business or entity directly engaged in the research, development, manufacture, sale, distribution, installation, or application of products and/or services that promote energy generation, efficiency and conservation, renewable and alternative energy production, waste management and/or organizations that are focused on environmental stewardship."[136] In this *Maryland Energy Outlook*, economic activities related to renewable energy and energy efficiency are considered to be the primary elements of the "clean energy sector."

On February 6, 2009, Governor O'Malley explained that the State of Maryland is "working on a number of different fronts to promote research, generation, and advancement of alternative energy in Maryland – which is helping to create jobs in the present and very importantly laying the groundwork for future job creation as these technologies progress." The Governor additionally pledged to create "at least 100,000 (more) green jobs by 2015..." and noted that "we are working across our State government – along with partners in organized labor, and in the private, academic, and non-profit sectors – to implement twenty action items which are designed to create new jobs and advance eco-friendly technologies…"[137] These statements, made at the "Good Jobs, Green Jobs" National Conference, highlights Maryland's commitment to accelerating the transition to a green-collar economy.

[136] Governor's Workforce Investment Board, *Maryland's Energy Industry Workforce Report: Preparing Today's Workers for Tomorrow's Opportunities*, September 2009, http://www.mdworkforce.com/pub/pdf/energyworkforce.pdf
[137] Office of Governor Martin O'Malley, February 2009, http://www.governor.maryland.gov/speeches/090206.asp

In support of this effort, Governor O'Malley and the General Assembly created the Maryland Clean Energy Center, which was launched in January 2009 with the intention of helping facilitate Maryland's clean energy economic development. The purpose of the Center is to encourage deployment of clean energy technologies across Maryland, assist newly developed technologies with pilot projects; collect, analyze and disseminate industry data; and provide outreach and technical support to further the clean energy industry in Maryland. The Center is structured as a not-for-profit quasi-governmental corporation with the support of many State government agencies, including the Office of the Governor and the MEA. It was not, however, provided with any General Funds for start-up or operating expenses, and its effectiveness is limited by its need to raise its own funds.

MEA is also leading a Clean Energy Economic Development Initiative (CEEDI) program, in partnership with the Maryland Clean Energy Center and the Department of Business and Economic Development, using federal stimulus funding, to establish funding for clean, green energy businesses and organizations. Funding opportunities through the CEEDI program are expected to come in the form of loans and grants.

To attract more green firms to Maryland, the State has begun to build its workforce by tailoring education and training programs specifically for relevant industries. Formal educational opportunities for renewable energy and energy efficiency training are in place to expand overall green job employment. For example, MEA and the Department of Housing and Community Development have launched home weatherization and home energy auditor training programs at 16 community colleges, and Maryland has already trained hundreds of weatherization technicians.

Similarly, Frostburg State University now offers a program on design, installation, and maintenance of residential PV and wind generation systems. The program includes an 8-week online course supported by a 3-day instructional and hands-on training program. This program prepares students for entry-level certification tests given by the North American Board of Certified Energy Practitioners, Inc. (NABCEP).[138] In addition, the University of Maryland at College Park houses the University of Maryland Energy Research Center (UMERC). The UMERC is a multi-disciplinary initiative run by the School of Engineering that focuses on energy science and technology, with a special focus on alternative energy generation and storage.[139]

Maryland community colleges and universities offer numerous programs and degrees in areas that may not be specific to clean energy technologies, but provide skills that are needed by firms involved in these technology areas. Among other available resources is the newly created Maryland Center for Construction Education and Innovation at Towson University, whose purpose is to serve as a repository of information on existing training programs and resources for prospective workers in the construction industry.[140]

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[138] Interstate Renewable Energy Council. "Renewable Energy Training Catalog." August 12, 2009. <http://www.irecusa.org/trainingCatalog/providerListing.php?id=109>.
[139] University of Maryland Energy Research Center. "About the UM Energy Research Center." <http://www.umerc.umd.edu/about/index.html>.
[140] Governor's Workforce Investment Board, *Maryland's Construction Industry Workforce Report*, September 2009, www.mdworkforce.com/news/constenforum/constructionlayout.doc

Maryland's ability to attract clean energy companies hinges on other attributes. First, it has a highly educated workforce. With more than 2.9 million workers, Maryland leads the nation in the percentage of its workforce, 25 years of age and older, with a bachelor's degree or higher (37%) and in the percentage of its workforce employed in professional and technical fields (25%).[141] In addition, the State has a sophisticated infrastructure network, including seaports, airports, and rail and interstate highways that are attractive to energy manufacturing and professional service firms. Finally, Maryland is geographically close to Washington, DC, with its many federal agencies and other organizations that support clean energy development.

5.2 What Are the Results So Far?

The number of jobs in America's emerging clean energy economy grew nearly two and a half times faster than overall jobs between 1998 and 2007, according to a recent report by The Pew Charitable Trusts[142]. Pew found that jobs in the clean energy economy grew at a national rate of 9.1 percent, while traditional jobs grew by only 3.7 percent between 1998 and 2007.

In Maryland, the Governor's Workforce Investment Board (GWIB) estimates that Maryland's green economy includes roughly 22,000 businesses, directly employing nearly 250,000 people and generating total wages of $14.6 billion.[143] Pew ranked Maryland as fifth in the nation in attracting venture capital for clean energy investments, raising $324 million during the years 2006-2008.

5.3 What More Can We Do?

To further strengthen and grow the clean energy sector in Maryland and create green jobs, the State should consider establishing a comprehensive clean energy economic development strategy and supporting initiatives to meet the goals of the GWIB and the Maryland Clean Energy Center.

5.3.1 Develop a Clean Energy Economic Development Strategy

Maryland lacks a comprehensive strategy for growing its clean energy sector. While the State has undertaken many initiatives that support businesses in the clean energy sector and help create green jobs, a strategic approach is needed to maximize the effectiveness of Maryland's efforts.

To guide Maryland's efforts to foster growth in clean energy, the State should assess which clean energy sectors hold the greatest economic development opportunities and job creation potential for Maryland. To begin this prioritization process, the State needs to identify the technology areas where it has a natural advantage over other states due to existing industries, research facilities, and other resources. Key among these resources are Maryland's indigenous renewable energy sources, including solar, wind, and ocean technologies.

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[141] Higher Education Transition Work Group, *Higher Education's Role in One Maryland*, January 2007 http://www.governor.maryland.gov/documents/transition/HigherEducation.pdf

[142] *The Clean Energy Economy: Repowering Jobs, Businesses and Investments Across America*, June 2009, The Pew Charitable Trusts, available at http://www.pewcenteronthestates.org/uploadedFiles/Clean_Economy_Report_Web.pdf

[143] Maryland Governor's Workforce Investment Board., *Maryland's Energy Industry Workforce Report: Preparing Today's Workers for Tomorrow's Opportunities*, September 2009. <http://www.mdworkforce.com/pub/pdf/energyworkforce.pdf>, pp. 5-6.

A clean energy economic development strategy should be bolstered by specific policies and programs. Such programs and policies could include, but not be limited to, the following:

- An economic development fund focused on supporting the growth of companies currently existing in Maryland as well as attracting new clean energy companies to the State;
- A suite of tax incentives to encourage the emerging clean energy industry;
- Creation of clean energy enterprise zones; and
- Commitment to in-state implementation of clean energy resources

Economic development fund. Several states have established targeted economic development funds to support clean energy industrial development. As discussed in the section below, these funds provide grants, low-interest loans, loan guarantees, and other financial incentives to attract new clean technology facilities or to support the expansion of existing businesses. Many funds also provide funding for research and development or early commercialization efforts. Many clean economic development funds receive their funding from a state public benefit fund or a similar systems charge on utility customers' bills.

Tax incentives. At least 11 states have adopted various tax incentives to encourage clean energy industrial development. Most of these incentives are in the form of business tax credits or exemptions for clean energy manufacturers and technology developers.[144]

Enterprise zones. Clean energy enterprise zones are a time-tested strategy used by multiple jurisdictions to encourage economic development in pre-determined locations. Projects locating in these zones may be eligible for any number and type of incentives based on the enabling acts that create the zones. Maryland has successfully used the "One Maryland" designations in the past to drive economic development to areas of the state where jobs are most needed. This concept could be revisited in a novel way to encourage clean energy generation, manufacturing, and service companies to bring projects to the State. Local jurisdictions would be able to identify such areas as part of their planning and zoning process and work with appropriate State agencies to implement the program and track the resulting impacts.

In-state implementation of clean energy resources. Maryland's economic development efforts will be more successful if they are focused on technologies that are actively being developed in the State. The correlation between actual wind energy installations and wind energy manufacturing facilities is an example of this relationship. It is not coincidental that the two states with the most wind energy capacity – Texas and Iowa[145] – are also the only two states that manufacture all major components of wind turbines.[146]

[144] Database of State Incentives for Renewables and Efficiency, http://www.dsireusa.org/, accessed September 17, 2009
[145] American Wind Energy Association, http://www.awea.org/projects/
[146] Iowa Department of Economic Development, http://www.iowalifechanging.com/Business/wind_energy.aspx

What Have Other States Done?

New Jersey

Through the Edison Innovation Clean Energy Manufacturing Fund (CEMF), supported by the New Jersey Economic Development Authority (EDA), New Jersey manufacturers of renewable energy or energy efficiency systems, products, or technologies are eligible to apply for up to $3.3 million in grants and interest-free loans. The grant portion of the assistance (up to $300,000) can be used for manufacturing site identification and procurement, design, and permits. The interest-free loan portion of the assistance (up to $3 million) can finance site improvements, equipment purchases, and facility construction completion. The CEMF is funded by a system benefits charge. It is anticipated that $12 million will be available annually for this program through 2012.[147]

Thus far, two businesses have received awards through the CEMF – Noveda Technologies, Inc. (October 2009) and Petra Solar, Inc. (July 2009). Noveda Technologies expects that the $3.3 million it received through the CEMF will yield more than $6.6 million in public/private investment and create 83 jobs in the company (almost 500% in its current staff) by 2013.[148] Petra Solar expects that its $3.3 million in funding will result in more than $7.6 million in public/private investment and create 164 jobs over the next two years.[149] Already, Petra Solar has tripled in size and has acquired a $200 million contract to produce 200,000 smart solar systems to be installed on utility and street light poles.[150]

Iowa

The Iowa Power Fund was created in 2007 to promote energy independence. The Fund provides financial assistance in the form of grants and loan guarantees to Iowa organizations involved in research and development and early commercialization of renewable energy and energy efficiency technologies. The Fund was set up to provide a total of $100 million in funding over a four-year time period.[151] In addition to the Power Fund, the Iowa Department of Economic Development (IDED) has established two renewable energy sectors – biofuels and wind energy – among primary target industries for its general economic development programs and funds.[152]

Iowa's focus on growing renewable energy industries has proved very effective. The State's 39 ethanol and 15 biodiesel plants[153] make it the largest producer of both fuels in the nation.[154] In

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147 New Jersey Economic Development Authority, *Financing Programs - Edison Innovation Clean Energy Manufacturing Fund (CEMF)*, http://www.njeda.com/web/Aspx_pg/Templates/Npic_Text.aspx?Doc_Id=1085&menuid=1359&topid=722&levelid=6&midid=1357

148 New Jersey Board of Public Utilities. "Noveda Technologies Awarded Funding under New Jersey's Clean Energy Manufacturing Fund." October 28, 2009. <http://www.state.nj.us/bpu/newsroom/news/pdf/20091028b.pdf>.

149 New Jersey Economic Development Authority. "Petra Solar is First Business Awarded Funding under New Jersey's Clean Energy Manufacturing Fund." July 8, 2009. <http://www.njeda.com/web/Aspx_pg/Templates/Press_Rls.aspx?topid=721&Doc_Id=1095&ParentDocID=163>.

150 The State of New Jersey. *Clean Energy in New Jersey*. "New Jersey's Clean Energy Success Stories." <http://www.njeda.com/web/pdf/CleanEnergySolution/NewJerseyCleanEnergyBrochure.pdf>, p. 7.

151 Iowa Office of Energy Independence, http://www.energy.iowa.gov/Power_Fund/index.html

152 For example, Business Sphere, Vol. 20, No. 1, http://www.iowalifechanging.com/business/downloads/bs0308.pdf, and Manufacturing.net, *Iowa Governor Woos Wind Turbine Manufacturers*, http://www.manufacturing.net/Iowa-Gov-Woos-Wind-Turbines.aspx?menuid=270

153 Iowa Renewable Fuels Association, http://www.iowarfa.org/

154 Iowa Office of Energy Independence, *Energy Information Report*, December 2008, page 34, http://www.energy.iowa.gov/OEI/docs/EnergyInformationReport2008.pdf

addition, the State is one of only two states that manufacturers all major components of wind turbines. It is estimated that 2,000 Iowans are employed by wind manufacturing companies.[155]

Michigan

Businesses engaged in alternative energy research, development, and manufacturing may claim a nonrefundable credit from the Michigan business tax. In 2006, Michigan enacted legislation allowing for the creation of Renewable Energy Renaissance Zones (RERZ). The Renaissance Zones offer significant tax benefits to facilities located within their boundaries. Facilities within a RERZ do not pay the Michigan business tax, personal and real property taxes, or local income taxes. These taxes may be abated for up to 15 years. Fifteen RERZs can be created in the State. Renaissance zone designations are approved based on local economic impacts, job creation, project viability, and other relevant criteria. Renaissance zones must be one distinct, continuous geographic area and must be supported by a tax abatement resolution from the city, village, or township in which the facility is located.[156]

Michigan has made great strides in supporting the development of green jobs. It is estimated that there are approximately 110,000 green jobs in the State, or 3.4% of the total employment of 3.2 million in Michigan. Of these green jobs, 41% are in clean transportation and fuels, 23% in energy efficiency, and 9% in renewable energy production. The remaining 26% are in natural resources conservation and pollution prevention, and environmental clean-up.[157]

How Will a Strategy for Clean Energy Economic Development Help Achieve Maryland Goals?

Aggressive clean energy economic development will help Maryland achieve Governor O'Malley's goal of creating 100,000 green jobs by 2015.

Energy efficiency offers the potential for significant growth in green-collar jobs. "Investments in efficiency have an additional benefit of creating new, high-quality 'green-collar' jobs for the state," explains a 2008 ACEEE report.[158] The report further notes that if Maryland were to reach an energy efficiency goal of reducing 22,000 GWh of electricity demand, over 8,000 jobs could be created and nearly $500 million in increased wages could result. Finally, the report finds that investments made in energy efficiency are likely to be spent locally as compared to investments in conventional electricity generation, which are primarily spent outside Maryland. The White House Council of Economic Advisers estimates that $92,136 of government spending creates one job-year.[159] Using this formula, the $52.3 million allocation of ARRA funds for Maryland through the Energy Efficiency and Conservation Block Grant program[160] can be expected to generate approximately 570 job-years.

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[155] Office of Energy Independence, *Energy Information Report*, December 2008, page 35
[156] Database of State Incentives for Renewables and Efficiency, http://www.dsireusa.org/
[157] Michigan Department of Energy, Labor & Economic Growth, Michigan Green Jobs Report 2009, May 2009, pages 14-15, http://www.michigan.gov/documents/nwlb/GJC_GreenReport_Print_277833_7.pdf
[158] ACEEE, *Energy Efficiency: The First Fuel for a Clean Energy Future*, February 2008
[159] Executive Office of the President, Council of Economic Advisers, *Estimates of Job Creation from the American Recovery and Reinvestment Act of 2009*, May 2009, at http://www.whitehouse.gov/assets/documents/Job-Years_Revised5-8.pdf
[160] MEA, March 27, 2009 press release, http://energy.maryland.gov/documents/blockgrantpresser032709FINAL.pdf

Renewable energy development in Maryland can play an important part in providing additional green jobs. The National Renewable Energy Laboratory (NREL) reports that Maryland has wind resources consistent with utility-scale production. Several areas of the State are estimated to have good-to-excellent wind resources, including the barrier islands along the Atlantic coast, the southeastern shore of Chesapeake Bay, and ridge crests in the western part of the State.[161] On-shore and offshore wind development would require a trained and competent workforce. According to an analysis conducted by Navigant Consulting, the construction of a typical 100 MW wind farm in Texas creates approximately 500 direct jobs and 574 indirect and induced jobs. Once operational, such a wind farm employs 27 people directly and creates 22 indirect and induced jobs.[162] At the national level, the U.S. Department of Energy (DOE) estimates the potential job impact of a concerted effort to produce 20% of U.S. electricity from wind. DOE estimates that such wind energy development would support an average of 258,000 jobs annually (including direct, indirect and induced jobs). The DOE report also projects that Maryland could see 5,000-10,000 additional manufacturing jobs as a result of such a national effort.[163]

Green jobs are not limited to the wind energy sector. One Maryland-based company has cited that for each 50MW woody biomass plant installed, 400 new green jobs are created. , Further, Maryland has an abundance of solar energy available for both direct use and electricity generation. Maryland has made a significant commitment to developing in-state solar energy resources by establishing a goal of deriving 2.0% of electricity sales from solar by 2022.[164] To achieve this goal would require the installation of approximately 1,500 MW of solar PV in the State.[165] This level of solar PV development could result in significant economic activity in Maryland related to solar panel sales and installation services.

What Are the Advantages and Disadvantages of Developing a Clean Energy Economic Development Strategy?

Advantages include:

- Marylanders could benefit from greater employment opportunities through an economy focused on clean energy. A recent study suggests that the renewable energy and energy efficiency sectors generate more than 2.5 times as many jobs per dollar of revenues as do the oil and natural gas sectors.[166]
- A more strategic and comprehensive approach to clean energy economic development would lead to more efficient and effective utilization of current economic development resources.
- The clean energy sector is expected to be a growth engine in the coming decades in the United States and worldwide. Strong early positioning in this high-growth sector will provide Maryland with long-term economic benefits.

[161] U.S Department of Energy, *Maryland Wind Resource Map*, http://www.windpoweringamerica.gov/maps_template.asp?stateab=md
[162] Navigant Consulting, http://www.seref.us/pdf/2009SolarJobsStudy-2-08.pdf
[163] U.S. DOE, *20% Wind Energy by 2030*, July 2008, pages 204-211, at http://www1.eere.energy.gov/windandhydro/pdfs/41869.pdf,
[164] Database of State Incentives for Renewables and Efficiency (DSIRE), http://www.dsireusa.org/
[165] DSIRE, http://www.dsireusa.org/
[166] American Solar Energy Society, *Green Collar Jobs in the U.S. and Colorado*, January 2009 http://www.ases.org/images/stories/ASES/pdfs/CO_Jobs_Rpt_Jan2009_summary.pdf

- More aggressive clean energy economic development efforts will enable Maryland to compete with neighboring states that have established clean energy funds and other incentive mechanisms for their clean energy industrial growth.

Disadvantages include:

- Many clean energy economic development programs and tools require a financial commitment from the State. This could be a major challenge, considering the Maryland's current fiscal situation.

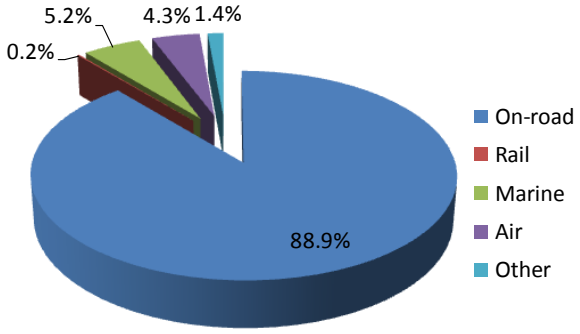
5.4 Recommendations

6.0 Options to Increase Transportation Energy Independence

Maryland's transportation sector uses approximately 32% of all energy consumed in the State, most of it imported from outside of the State. The impact of this on consumers is great, both in terms of price paid at the pump and vulnerability to political and supply interruptions. The purpose of this chapter is to explore policy and program options to reduce transportation fuel demand and petroleum use in Maryland, thereby supporting future steps toward independence from imported energy.

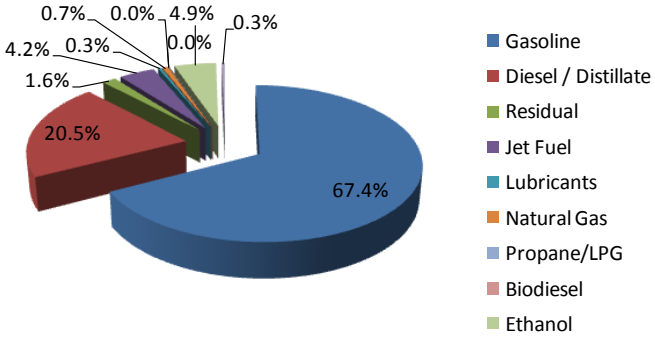
Total fuel used for transportation in Maryland is approximately 4.1 billion gallons, or 476 trillion Btu of energy. As shown in Exhibit 6.1, on-road transportation accounts for nearly 90% of all transportation sector energy used in Maryland. Gasoline and diesel account for 88.2% of fuel demand on an energy basis (Exhibit 6.). Ethanol is the next largest percentage fuel, primarily due to its use in E10 gasoline blends, accounting for 4.9% of total fuel energy used. All other fuels play a minor role.

Exhibit 6.1: Energy Use by Transportation Sector



Source: EIA State Energy Profile, FHWA Highway Statistics, Maryland Department of the Environment, Maryland Clean Cities Coalition

Exhibit 6.2: Transportation Sector Energy Use by Fuel (Energy Basis)

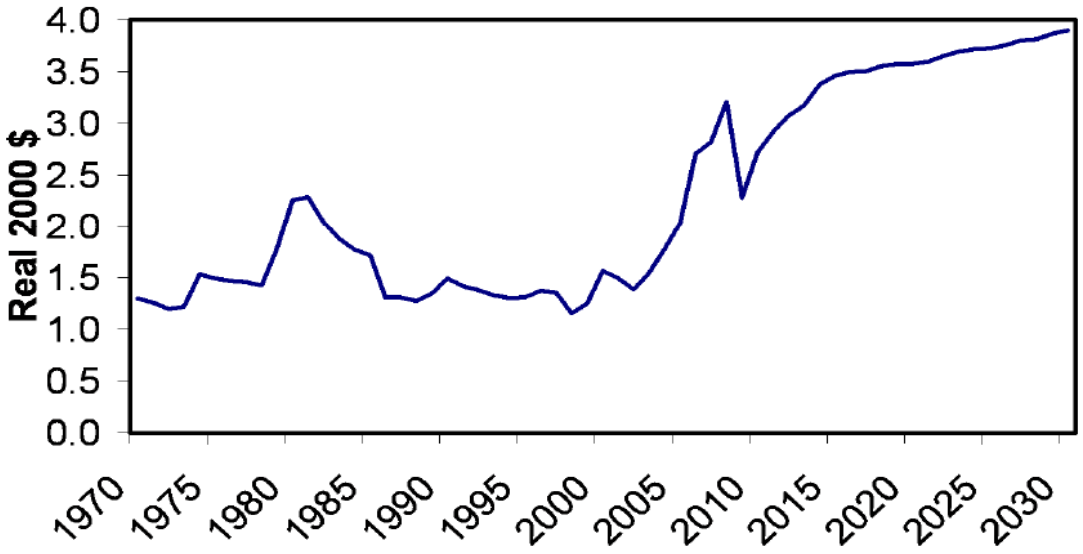


Source: EIA State Energy Profile, FHWA Highway Statistics, Maryland Department of the Environment, Maryland Clean Cities Coalition

Several drivers currently affect the State's transportation fuel mix and demand picture:

- Energy security concerns in Maryland and at the national level ;
- Greenhouse gas emissions;
- Fuel price volatility;
- Federal and State legislative requirements, including Corporate Average Fuel Economy (CAFE) and Energy Independence and Security Act of 2007 (EISA);
- Smart Growth/efficient land use policies that impact transportation planning and public services.

Exhibit 6.3 Projected Gasoline Fuel Prices



Perhaps the most compelling issue affecting transportation energy independence is the price and price volatility of petroleum fuel. According to the Energy Information Administration's (EIA) Annual Energy Outlook 2009 (AEO 2009), a rapid increase in petroleum prices over the next ten years is expected. Exhibit 6.3 illustrates projected gasoline fuel costs.[167,168] Gasoline prices in year 2018 are projected to be $3.50 per gallon in 2000 dollars (or roughly $4.38 in 2009 dollars).[169]

6.1 What is Maryland Currently Doing?

Maryland currently has a number of policies and programs in place to reduce transportation energy demand and to promote alternative fuel vehicles (AFV) and fuels, electrically-powered transportation, and smart growth practices.

Although not a State policy, according to the Maryland Department of the Environment (MDE), most of the gasoline used in Maryland contains 10% ethanol (E10).[170] The primary reason for its use is as a fuel oxygenate to improve combustion and to reduce vehicle exhaust emissions; however, a secondary effect is to reduce petroleum-based fuel demand by roughly 10%.

[167] "Office of Integrated Analysis and Forecasting, Energy Information Administration, Annual Energy Outlook 2009: With Projections to 2030", U.S. Department of Energy, Energy Information Administration, DOE/EIA-0383(2009), March 2009.
[168] White, Thomas, "The Impact of Changing Fuel Prices and GDP Projections on VMT and Oil Use and National Highway Speed Limits Impacts", U.S. Department of Energy, Presentation at the 2009 Society of Automotive Engineers Government and Industry Meeting, February 2009.
[169] Consumer Price Index Calculator Online Tool, United States Department of Labor, Bureau of Labor Statistics, http://www.bls.gov/data/inflation_calculator.htm.
[170] Alternative Fuels and Alternative Fuel Stations webpage, Maryland Department of the Environment, http://www.mde.maryland.gov/Programs/AirPrograms/Mobile_Sources/afv/fuels.asp.

The Maryland Clean Cities Coalition (MCCC), operated by the Maryland Energy Administration (MEA), is one of the 80-plus nationwide coalitions in the U.S. Department of Energy's Clean Cities Program. Clean Cities is focused on petroleum reduction through the use of alternative fuels, hybrid-electric vehicles (HEV), battery-electric vehicles (BEV), idle-reduction, and other fuel reduction measures.[171] MCCC works with State and private fleets, fuel providers, and others to facilitate the availability and use of alternative fuels and vehicles in Maryland. In the past MCCC has provided grant incentives for the installation of alternative fuel stations and alternative fuel blending capacity at fuel terminals. These grants have enabled the opening of several new stations offering E85 (a blend of 85% ethanol and 15% gasoline) and alternate distillate fuel blending terminals in the past several years.

The State fleet currently contains a large number of alternative fuel vehicles, of which 1,419 are flexible-fuel vehicles (FFV) capable of using E85. E85 use of the State fleet FFVs is low, due to fuel availability and price, and a lack of State mandates on its use. Maryland also requires that 50% of the State's diesel vehicles use a 5% blend of biodiesel (B5). In reality, the B5 usage is closer to 100%.

There are currently only seventeen E85 stations (ten private and seven public) in Maryland. Several E85 stations have been installed at State fleet locations to increase the use of E85. There are currently only ten stations (five private and five public) selling biodiesel blends in Maryland.

The MEA, the Maryland Clean Cities Coalition, and several project partners, have recently been awarded nearly $6 million in Federal stimulus funds to provide incremental funding for the purchase of 150 heavy-duty hybrid-electric trucks.[172] Heavy-duty vehicles use a much larger amount of fuel annually due to their weight and use patterns, so they are ideal applications for hybridization.

Ethanol used in Maryland is typically imported from the Midwest in rail cars. The State offers a production credit of up to 20 cents per gallon for ethanol produced from "small grains" like wheat and barley.[173] All available ethanol credits under the current statute have been awarded to a planned barley ethanol facility.

The Commuter Connections program has been providing Maryland residents with information about alternative commuting options, such as teleworking, mass transit use, rideshare/ carpool/ vanpool, Guaranteed Ride Home program, alternative work schedules (e.g. four ten-hour days instead of five eight-hour days), bike to work, walk to work, etc. since 1974.

6.2 What Are the Results So Far?

Maryland has made significant strides in reducing statewide petroleum use but still has a long way to go. Approximately 305 million gallons of ethanol is consumed in Maryland each year as a result of E10 use. E85 use in all registered vehicles in Maryland is not tracked well, but is considered to

[171] Clean Cities: Mission and Background Webpage, U.S. Department of Energy, http://www1.eere.energy.gov/cleancities/mission.html.
[172] "Maryland Receives Nearly $6 Million in Clean Cities Grant Funding to Support Hybrid Electric Vehicles", Press Release, Maryland Energy Administration, August 26, 2009.
[173] Ethanol production credits are as follows: a) $0.20 per gallon of ethanol produced from small grains such as wheat, rye, triticale, oats, and hulled or hull-less barley; and b) $0.05 per gallon of ethanol produced from other agricultural products. The Board may not certify ethanol production credits for more than a total of 15 million gallons per calendar year, of which at least 10 million gallons must be produced from small grains. (Reference Maryland Statutes, http://mlis.state.md.us, Agriculture Code 10-1501 through 10-1507).

consist of several hundred thousand gallons per year for several years. The number of stations offering E85 was stagnant for several years, but has grown by a few public and private stations in the past several years. Accurate figures for biodiesel use are not available, but it considered to have been increasing by roughly 150,000 gallons per year to a level of approximately one million gallons of pure biodiesel (B100). The Maryland State fleet is required to purchase alternative fueled vehicles (AFV) for at least 75% of new light-duty vehicle acquisitions. According to the Maryland Department of General Services, the State fleet includes 9,045 vehicles, including 1,419 E85-capable flexible fuel vehicles (FFV) and 144 compressed natural gas (CNG) vehicles. An additional 200 FFVs will be added to the State vehicle inventory in each of the next two years. The State fleet also includes 63 hybrid-electric vehicles, with plans to purchase an additional 30 vehicles in each of the next two years.

Statewide, there are approximately a total of 150,000 FFVs. The number of hybrid-electric vehicles in Maryland is not known, but the market penetration of hybrids is approximately 2 to 3% of new light-duty vehicles.

Electric-drive vehicles in the form of hybrid-electric vehicles are a common sight in Maryland with increasing sales each year. The numbers of fully electric vehicles, such as plug-in hybrid-electric vehicles, in the State are not known, but are very low. The majority of the electric-drive vehicles are likely low-speed nonroad vehicles that are used on large private properties and campuses.

The Commuter Connections program has developed a comprehensive set of metrics to track the effectiveness of the program. The methodology is one of the most comprehensive in the country and has been adopted by other large cities with commuting problems such as Atlanta and Los Angeles.[174] The Commuter Connections program has increased its effectiveness each year, but according to the program staff has just been able to keep up with the population increase.

6.3 What More Can We Do?

Maryland has the opportunity to make significant progress in reducing petroleum use and increasing petroleum independence by focusing on several near-term options. The key is to focus on vehicle and fuel technology areas with near-term potential for petroleum reduction that will also enable Maryland to meet Federal renewable fuel use requirements.

During the *Maryland Energy Outlook* development process, several policy options to decrease transportation sector fuel consumption and to increase use of alternative fuels were considered. Among those options were financial incentives for biofuels production and use, support and development of alternative fuels other than biofuels, lead-by-example activities, idle reduction strategies, and promotion of mass transit. Based on policies and programs that already exist and potential efficiency improvements, the most promising options were selected for further analysis.

These options include:

- Increase the Availability and Use High-Level Ethanol Blends

[174] Personal communication with Nicholas Ramfos, Director, Commuter Connections Program, June 2009.

- Increase the Availability and Use of Biodiesel Blends
- Promote Electric-Drive Vehicles
- Lead-by-Example to "Green" the State Fleet
- Increase Support for Commuter Connections Program

6.3.1 Increase the Availability and Use High-Level Ethanol Blends

What are Ethanol Blended Fuels?

According to the U.S. Environmental Protection Agency, low-level gasoline/ethanol blends can contain up to 10% ethanol (i.e. E10). E10 can be used in all gasoline vehicles without modification. Low-level ethanol blends in gasoline have been used in many states, including Maryland, as an oxygenate in vehicles to improve fuel combustion and to reduce emissions.

Ethanol fuel is currently produced using corn as a feedstock which has long-term sustainability limitations. Cellulosic ethanol is the next generation of ethanol production methods. Cellulosic ethanol can be produced from a wide variety of biomass feedstocks especially including sources such as fast growing grasses such as switchgrass and other forest and agricultural wastes that do not impact the food supply. Industry leaders and experts have advised that cellulosic ethanol production technology is under development, but is not expected to produce the large quantities required to meet the State and national ethanol demands for roughly ten years. The infrastructure developed for, and expedience developed by, using current ethanol will allow cellulosic ethanol a smoother transition when commercially available in large quantities.

E85 (85% ethanol, 15% gasoline) is the only currently allowable higher-level blend. It can only be used in flexible fuel vehicles (FFV); it cannot be used in conventional gasoline engine vehicles. FFVs are essentially gasoline vehicles that have several components upgraded for compatibility with alcohol fuels. Unlike other alternative fuels vehicles that suffer from low vehicle availability or high purchase costs, vehicles that can use E85 are common since many domestic car models are flexible fuel vehicles (FFV) that are able to use E85. The number of FFVs will grow in the coming years because most domestic manufacturers have plans to produce a large percentage of the vehicles as FFVs.

What Can Maryland Do to Increase the Availability and Use of High-Level Ethanol Blends?

The Energy Independence and Security Act of 2007 mandates a rapid increase in ethanol use over the next decade, from roughly 6.45% (volume basis) in 2009 to 13.26% in 2018. The current E10 use is sufficient to meet this requirement through 2013. For 2014 and beyond, additional use of ethanol will be required if no changes to EISA are made. Based on analysis earlier in this study, an additional 96.6 million gallons of ethanol per year will be required by 2018 to meet these mandates.

To meet this additional volume, the following options could be considered:

- Use of higher level ethanol blends (i.e. greater than E10) in the gasoline motor fuel pool for current and future conventional gasoline engines
- Allow ethanol blending in conventional gasoline and not just reformulated gasoline (RFG).

- Increased use of E85 in flexible fuel vehicles (FFV)

The first option is appealing because even a small increase in ethanol percentage would lead to a significant volumetric increase. However, at this time, gasoline is legally able to include only up to 10% ethanol. Higher level intermediate ethanol blends (e.g. E15 and E20) are being studied by the U.S. Department of Energy (USDOE) and U.S. Environmental Protection Agency (USEPA) to determine whether their use is feasible without causing engine and fuel system damage or operability issues with existing and new gasoline vehicles and equipment.[175] The second option would only result in a small increase in ethanol use since most gasoline in Maryland already includes 10% ethanol.

Therefore, until a final determination has been made whether to approve the use of intermediate level ethanol blends, the significant additional ethanol consumption required must come from higher use of E85 in FFVs.

E85, like other alternative fuels, suffers from a "chicken and egg" problem. E85 use is typically very low, so few stations are willing to invest in the necessary capital equipment to sell the fuel. Because throughput is low, the stations that are selling the fuel must buy it in small quantities at prices higher than those that can be achieved by buying in bulk. The stations then must sell the fuel at a higher cost to make up this difference and to pay for the dedicated fueling infrastructure at the station. The higher price is one factor that has caused people and commercial fleets to avoid using E85. Additionally, ethanol has less energy per unit of volume than gasoline. E85 has roughly 30%less energy per volume than gasoline, so the fuel must be priced accordingly to compete on a $/Btu or $/mile basis.

In order to be able to meet the EISA RFS goals and to begin a meaningful shift away from petroleum-based transportation fuels, a self-sustaining market for higher level ethanol blend fuel must be established that builds on the current and growing FFV population in the State. The solution requires four actions to be effective:

1) Ample number of FFVs
2) Convenient and widespread publicly available fueling stations
3) Competitive fuel price (on an energy basis), and
4) Education of current and potential FFV drivers about E85

Only when all of these are implemented will the fuel use be high enough and consistent enough to allow for lower cost bulk fuel purchases and to persuade the population to change their fuel choice. The first point is being addressed by vehicle manufacturers producing high percentages of vehicles that are FFVs, which will result in significantly more FFVs being on the road in the coming years.

This leaves the remaining three points to be addressed.

[175] "Effects of Intermediate Ethanol Blends on Legacy Vehicles and Small Non-Road Engines, Report 1", Oak Ridge National Laboratory and National Renewable Energy Laboratory, ORNL/TM-2008/117, NREL/TP-540-43543, October 2008.

Increase E85 Refueling Station Infrastructure

Several fuel dispensing locations for E85 have been installed in Maryland in the past several years. To increase the use of E85, the State should work with retailers and other stakeholders to continue increasing the availability of E85, with a focus on publicly accessible stations. Public stations can service both private and government fleets as well as individual customers, so they can have a much larger potential fuel throughput. A statewide analysis of alternative fuel vehicle locations based on registration data versus available fueling locations should be conducted by the State. This would help determine areas with high FFV populations and identify locations where new E85 fuel dispensing locations would have the largest use. The MEA Biofuels Grant Program, which provided fueling stations with $12,500 to install eight E85 fuel dispensing infrastructure, has been successful in the past in providing incentives for fuel distribution companies to install new alternative fuel dispensing equipment. The program should be continued to maintain momentum as more drivers decide to switch to alternative fuels. Another option to achieve the same goal is to provide tax credits for installing E85 refueling dispensers at public refueling stations.

E85 Fuel Price Assistance

E85 sales will not increase unless the fuel is priced lower than gasoline on an energy basis. E85 currently costs 30% more than gasoline on an energy basis. Experience has shown that one-time, or short-term, discounts and rebates will change people's behavior only while they are in effect, and behavior will revert once the incentives expire. A long-term E85 fuel price buydown is needed to maintain the price below gasoline on an energy basis to create consistent demand that will drive additional fueling station installations and lower price bulk fuel sales. For example, a fuel tax exemption or tax credits could be used to provide this price assistance.

Education Campaign

Ethanol has been discussed in the media for several years and several domestic manufacturers have made FFV equipment standard on many of their common models. However, it is important to perpetuate the message that explains: why ethanol is a useful and important fuel; what vehicles use the fuel; what the performance differences between gasoline and E85 are; and where to buy the fuel. Consumer education is a key component of a strategy to increase E85 use in Maryland. State, county, and local governments in Maryland have fleets with a high percentage of FFVs due to federal requirements. These fleets should be targeted initially to give the education initiative a jump start. A public education program should follow, highlighting the successes of the State and county experiences.

What is Maryland's Experience with High-Level Ethanol Blends?

Use of E85 is not tracked well in Maryland, but is estimated to have been several hundred thousand gallons per year for several years. According to the DOE Alternative Fuels Data Center, Maryland has seventeen stations offering E85. Ten of the stations are public-access; the rest are limited to fleet use only.[176] For comparison, there are approximately 1,700 gasoline stations in the State.[177] There were over 150,000 E85 compatible FFVs registered in Maryland in 2008. The numbers will increase in the coming years as manufacturers produce more FFV models.

[176] Alternative Fuels and Advanced Vehicles Data Center: Alternative Fueling Station Locator, Energy Efficiency and Renewable Energy Office, U.S. Department of Energy, http://www.afdc.energy.gov/afdc/locator/stations/state, Accessed on 8/27/09.
[177] U.S. Census Bureau 2002 Statistics, http://www.census.gov/econ/census02/data/industry/E4471.HTM, Accessed on 8/27/09.

Gasoline in the Central Atlantic region cost an average of $2.54/gallon in July 2009 while E85 cost an average of $2.35/gallon (7% lower).[178] The E85 cost equates to an energy adjusted cost of $3.32/gasoline gallon equivalent (30% higher).

What Are Other States' Experiences with High-Level Ethanol Blends?

Several initiatives have been undertaken across the country to increase the use of E85. The Twin Cities Clean Cities Coalition in Minneapolis-St. Paul, Minnesota partnered with fuel station company Holiday Station Stores to install a large number of E85 fueling stations: a total of 48 are currently in operation in Minnesota, with an additional four in Wisconsin and one in South Dakota.[179] Holiday priced the fuel competitively so that users would break-even or save money compared to gasoline. A public awareness campaign including advertisements on radio and television, mirror hang tags for new cars in showrooms, $0.85/gallon promotions, and other strategies were used to promote the fuel and increase its use. E85 use in the upper Midwest part of the country is the highest in the country, with 700 of the 1,500 stations nationwide. These efforts are enhanced by the fact that the feedstock is locally grown and the fuel is locally produced, which minimizes the transportation costs.

In addition, the State of Minnesota has actively promoted the use of ethanol by providing incentives for ethanol producers and establishing an ethanol blending mandate. Minnesota's sixteen ethanol plants have a capacity of over 600 million gallons, and approximately 20% of the Minnesota corn crop is made into ethanol. The State has over 300 commercial E85 stations.[180]

The State of Tennessee has also conducted aggressive development efforts for biofuels refueling stations. One and a half (1.5) million dollars was provided to the State Department of Transportation to develop a Biofuel Green Island Corridor network along highways in the State. An additional $480,000 from the State CMAQ funding was provided to locate biofuels infrastructure in areas of nonattainment or maintenance for air quality standards. The program has installed 26 E85 stations in the State.[181]

A similar initiative was undertaken under the auspices of the U.S. Department of Energy to develop biofuels infrastructure along the I-65 corridor between Gary, Indiana and Mobile, Alabama. The project allows a driver of a flexible fuel vehicle the ability to travel along this entire Interstate corridor using E85. A total of 31 E85 refueling stations were constructed in five states: Indiana, Kentucky, Tennessee, and Alabama. The DOE Clean Cities Program, the individual Clean Cities Coalitions along the route, and the Indiana Office of Energy Development were all involved in the project.[182]

[178] Clean Cities Alternative Fuel Price Report, U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, July 2009, http://www.afdc.energy.gov/afdc/pdfs/afpr_jul_09.pdf.
[179] Holiday Stationstores website, http://www.holidaystationstores.com/petroleum/petroleum.html.
[180] "About the Ethanol Program", Minnesota Department of Agriculture, http://www.mda.state.mn.us/renewable/ethanol/about.htm.
[181] "Biofuel Green Island Corridor Grant Project", Tennessee Department of Transportation, http://www.tdot.state.tn.us/biofuel/application.htm.
[182] "I-65: America's Biofuels Corridor", Indiana Office of Energy Development website, http://www.in.gov/oed/2396.htm.

How will Increasing Use and Availability of High-Level Ethanol Blends Help Achieve Maryland's Goals?

- **GHG Reduction:** Increasing the use of higher-level ethanol blends within the State through infrastructure development and education have the potential to decrease the total consumption of petroleum for transportation use in the short-term (through 2012) by 160 million gallons and reduce greenhouse gas emissions in the state by 0.3 million tons.
- **RFS:** Increased use of high-level ethanol blends will also enable Maryland to meet the RFS requirements through 2018.

What are the Advantages and Disadvantages of Increasing the Availability and Use of High-Level Ethanol Blends?

Advantages include:

- The State has a large population of FFVs. The number of FFVs is expected to increase since more models will be sold by domestic car makers in the coming years.
- Helps develop a self-sustaining market for E85.
- Helps the State meet its RFS requirements.
- Improves air quality.
- Improves State and national energy security.

Disadvantages include:

- State funding will be required to incentivize installation of E85 infrastructure.
- State funding will be required, at least in the near-term, for buying down E85 fuel price to maintain a lower price than gasoline.
- Lower energy content of E85 decreases fuel economy, making the fuel less attractive to consumers.
- Modest GHG benefits of first-generation ethanol and other environmental concerns regarding ethanol production lessen consumer acceptance and may threaten future economic viability of the fuel.

6.3.2 Increase the Availability and Use of Biodiesel Blends

What are Biodiesel and Alternate Distillate Blended Fuels?

Alternate distillate fuels are distillate fuels derived from plant and animal fats that can be used in diesel engines. Biodiesel, produced from the transesterification of plant and animal fats, is the most commonly known and currently available alternate distillate fuel. Renewable diesel (produced from biological materials through a thermal depolymerization process) and co-processed renewable diesel (small amounts of plant and animal fats co-processed with petroleum) are other types of alternate distillate fuels.[183] From here on, all alternate distillate fuels are referred to as biodiesel.

[183] Biodiesel, Renewable Diesel, & Co-Processed Renewable Diesel, National Biodiesel Board, http://www.biodiesel.org/pdf_files/fuelfactsheets/Co-Processing%20One%20Pager.pdf.

Biodiesel is typically blended with diesel fuel in different proportions. Diesel engines can technically operate on 100% biodiesel (B100), but blends from 5% (B5) to 20% (B20) are more common. A B5 blend can safely be used by all diesel vehicles.[184] Biodiesel blends are used for various reasons, including: improving the combustion efficiency and exhaust emissions, increasing the renewable portion of the fuel, and improving the vehicle greenhouse gas emissions.

What Can Maryland Do to Increase the Availability and Use of Biodiesel Blends?

The Energy Independence and Security Act of 2007 biofuels use mandate requires an increase in the use of biodiesel over the next decade. The required percentage of biodiesel in the diesel fuel pool will rise from roughly 1.4% (on a volume basis) in 2009 to 3.96% in 2018. Biodiesel use in Maryland is roughly 10% of the amount required to meet the RFS requirement for 2009, so additional transportation use of biodiesel is required for 2009 and beyond. Options for increasing biodiesel use include:

- Mandate use of low-level biodiesel blends.
- Increase use of higher-level biodiesel blends in diesel vehicles.

Increasing the use of higher-level blends will be a more expensive and slower expansion since higher-level blends are seen as alternative fuels which will have limited appeal to users. Meeting the RFS requirements requires an effective near-term solution, so mandating low-level blends are the only realistic option. Promoting higher-level blends is important and should be reconsidered once low-level blends have been instituted.

In addition, the biodiesel blending capacity of the fuel distribution system must be improved to be ready to meet the anticipated demand.

Mandate the Use of Low-Level Biodiesel Blends

Maryland should consider instituting a biodiesel blending requirement. Mandating blends up to 5% would be relatively straightforward, since the diesel fuel specification allows for up to 5% biodiesel. Enacting this option would ensure that the RFS requirements would be met through 2018. The mandate could be introduced in steps, slowly increasing the biodiesel blending percentage up to the 3.96% required to meet the RFS requirements in 2018. The existing diesel storage and dispensing infrastructure would be used, eliminating significant additional infrastructure related costs. As discussed below, this approach has already been adopted by several states which provide valuable lessons as to how such a program can be structured.

Increase Use of Higher-Level Biodiesel Blends

The second option is to expand the use of higher level biodiesel blends (above B5). This option is limited because most diesel engine manufacturers have not endorsed higher level biodiesel blends. Higher-level blends require additional separate storage and dispensing infrastructure, which poses a significant limitation to the overall effectiveness of this option. The potential market for use of higher level blends is limited and not expected to result in biodiesel use sufficient to meet the RFS requirements.

[184] "New Biodiesel Specifications Published by ASTM International", Release #8079, October 2008, ASTM International, http://astmnewsroom.org/default.aspx?pageid=1515.

Increase Biodiesel Blending Capacity

Pure biodiesel (B100) cannot be transported through the fuel pipelines, so it must be blended with diesel fuel at petroleum distribution terminals. A key aspect of providing reliable fuel blends at competitive prices is the ability to produce the blends at fuel distribution terminals. This allows fuel blenders to alter the percentage of biodiesel in the fuel to react to seasonal changes, differential fuel prices compared to diesel, and customer demands. Increased biodiesel use from a biodiesel mandate or increased use of higher level blends would require additional terminal blending infrastructure. The State would need to provide incentive funding to petroleum distributors to help offset the costs of installing additional biodiesel blending capacity.

What is Maryland's Experience with Biodiesel?

Retail purchase of biodiesel is limited in Maryland. According to the DOE Alternative Fuels Data Center, Maryland has ten stations offering biodiesel blends (up to 20% biodiesel); five of these stations are public-access; the rest of the stations are limited to fleet use only.[185] Accurate figures for biodiesel use are not available, but estimates suggest it has been increasing by roughly 150,000 gallons per year to a level of approximately one million gallons of pure biodiesel (B100).[186]

Diesel fuel in the Central Atlantic region cost an average of $2.62/gallon while biodiesel blends from B10 to B100 ranged from $2.49/gallon to $2.71/gallon. The energy content difference between biodiesel and diesel is small.

The MEA Terminal Infrastructure Grant Program has been successful in the past in incentivizing fuel distribution companies to install biodiesel blending capacity at fueling terminals, and the U.S. Department of Energy Clean Cities Program also provided incentive funding in 2009 for installing additional biodiesel terminal blending infrastructure.

What Are Other States' Experiences with Biodiesel?

Several states including Minnesota, Pennsylvania, and Missouri have instituted low-level (2 to 5%) biodiesel blend mandates. In Minnesota, a 2% blend has been required since 2005. Minnesota will begin increasing the required percentage of biodiesel to its ultimate level of 20% by 2015.[187] In Pennsylvania, the required biodiesel blend percentage depends on in-state biodiesel production, increasing from 2% when production reaches 40 million gallons per year (MMgy) up to 20% when in-state production reaches 400 MMgy.[188] In-state production in Pennsylvania has passed the 40 MMgy threshold, so within one year all diesel fuel in the state will contain 2% biodiesel. In Missouri, all diesel fuel distributors will be required to provide consumers with a blend of at least 5% biodiesel by June 1, 2010.[189] However, if the price of biodiesel-blended fuel is higher than regular diesel, distributors will not be required to sell it.

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[185] Alternative Fuels and Advanced Vehicles Data Center: Alternative Fueling Station Locator, Energy Efficiency and Renewable Energy Office, U.S. Department of Energy, http://www.afdc.energy.gov/afdc/locator/stations/state, Accessed on August 27, 2009.
[186] Historical biodiesel usage in Maryland developed by New West Technologies, LLC for the Maryland Clean Cities Coalition.
[187] "Minnesota Passes Statewide B20 Mandate", National Biodiesel Board Press Release, May 12, 2008, http://www.biodiesel.org/resources/pressreleases/gen/20080512_mnb20.pdf.
[188] "Providing for the Study and Mandated Content of Biofuels", Pennsylvania House Bill 1202 (2007), P.N. 4184, http://www.legis.state.pa.us/CFDOCS/Legis/PN/Public/btCheck.cfm?txtType=HTM&sessYr=2007&sessInd=0&billBody=H&billTyp=B&billNbr=1202&pn=4184.
[189] "Missouri Senate passes B5 Mandate", Biodiesel Magazine, April 3, 2008, http://www.biodieselmagazine.com/article.jsp?article_id=2247

Several states, including Illinois and Iowa, provide tax incentives for biodiesel blends. In Illinois sales tax is reduced by 20% on biodiesel blends up to B10 and a full exemption from the state sales tax of 6.25% for B11 and above.[190] Iowa provides a 3 cent per gallon tax credit to retailers whose diesel sales are at least 50% biodiesel blends of B2 or higher.[191]

How will Increasing Use and Availability of Biodiesel Help Achieve Maryland's Goals?

- **GHG Reduction:** Implementation of programs to increase the use of biodiesel blends within the State can potentially decrease the total consumption of petroleum for transportation use in the short-term (through 2012) by 150 million gallons and reduce greenhouse gas emissions in the state by 1.2 million tons.
- **RFS:** Mandating low-level biodiesel blends would enable Maryland to meet the RFS requirements through 2018.
- **Green Jobs:** It is unclear whether implementing a biodiesel mandate will create additional jobs since increased biodiesel usage will come from decreased petroleum usage and the jobs related to each field if the fuel is produced outside of the State. It would shift the employment to a green job. Additional green jobs could be created by farming feedstock crops and producing the fuel in state.

What are the Advantages and Disadvantages of Increasing the Availability and Use of Biodiesel?

Advantages include:

- Low-level biodiesel blends (B5 and below) are included in the diesel fuel specification (ASTM D975) and can be immediately implemented in all diesel vehicles.
- Can potentially decrease the total consumption of petroleum for transportation use in the short-term (through 2012) by 150 million gallons and reduce greenhouse gas emissions in the state by 1.2 million tons.
- Implementing a low-level biodiesel mandate for a percentage equal to or above the RFS requirement will ensure Maryland's compliance with the regulation through 2018.
- Low biodiesel levels mean that fluctuations in biodiesel price will have a small price impact.
- Offsetting some of the State's diesel fuel demand with biodiesel will improve our energy security and air quality.
- Job creation from farming, fuel production, and fuel distribution.

Disadvantages include:

- Biodiesel fuel and diesel fuel prices track differently, so the price difference will vary depending on many factors such as petroleum prices, feedstock prices, biodiesel fuel prices, weather impacts on crops and production facilities, etc.

[190] "Illinois Ups Biodiesel Mandate by 5 Percent", Domestic Fuel website article, September 2, 2009, http://domesticfuel.com/2009/09/02/illinois-ups-biodiesel-mandate-to-5-percent/.
[191] "Iowa Biodiesel Laws and Incentives", Alternative Fuels Data Center, U.S. Department of Energy, http://www.afdc.energy.gov/afdc/progs/ind_state_laws.php/IA/BIOD.

6.3.3 Promote Electric-Drive Vehicles

What are Electric-Drive Vehicles?

Most hybrid-electric vehicles, like the Toyota Prius, can operate for only a few miles solely on battery power. The next evolutionary step towards fully electric vehicles is the plug-in hybrid-electric vehicle (PHEV). PHEVs have a larger battery pack with more stored energy to significantly increase the vehicle's driving range on electric power. The long-term goal is a fully electric vehicle using only energy stored in a battery pack to propel the vehicle. These vehicles are commonly referred to as electric-vehicles (EV) or battery-electric vehicles (BEV). PHEVs have a significant driving range since energy is provided both by a battery pack and an internal combustion engine. BEVs have limited range that will vary by vehicle, but for initial vehicles it will be roughly 100 miles for typical vehicles.

PHEVs are being designed by several automobile manufacturers. The Chevy Volt is expected to be released in 2011 with a price of $40,000.[192] For comparison, a Toyota Prius starts at approximately $22,500. Toyota is also developing a PHEV Prius, with a 2012 production date goal. Ford has also shown a PHEV version of the Escape which is expected to be available in 2012. Others, such as the four-passenger, $88,000 Fisker Karma scheduled for a mid-2010 release are aimed at luxury buyers. Fisker is also developing a $40,000 PHEV to slot in below the Karma.[193] PHEVs available directly from automobile manufacturers are currently eligible for up to a $2,500 IRS tax credit to help to reduce the incremental cost.[194]

Battery technology suitable for storing the energy in PHEVs and BEVs has advanced significantly over the past ten years and is now suitable for use in commercially available vehicles. The Electric Power Research Institute (EPRI) estimates that since half the vehicles on the road are driven 25 miles a day or less, a PHEV with even a 20-mile range battery system could reduce petroleum usage by about 60%.[195] The U.S. Department of Transportation, Bureau of Transportation Statistics estimates agree with these estimates that 78% of vehicles travel 40 miles or less per day commuting to work, so replacing these vehicles with an BEV or PHEV with a 40 mile electric-only range would reduce petroleum usage by roughly the same percentage.[196]

The batteries are currently very expensive, so the battery capacity is a compromise between driving range and cost. As a result, PHEVs and BEVs are significantly more expensive than conventional vehicles. Exact prices are not known at this time because commercial versions of these vehicles have not yet been released.

Currently, electricity-driven transportation is the most efficient means to propel a vehicle, especially when combined with the inherent benefit of the regenerative braking feature that can recover some of the vehicle's braking energy as current hybrid-electric vehicles do. It is critical that fuel use,

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192 "Chevy Volt: A Lot of Unanswered Questions", CNN Money Website, http://money.cnn.com/2009/10/15/autos/volt_problems.fortune.
193 "Fisker Automotive Awarded $528M from US Department of Energy", News page of Fisker Automotive Website, http://karma.fiskerautomotive.com/news_items.
194 U.S. Department of the Treasury, Internal Revenue Service, Vehicle Credits website, http://www.irs.gov/formspubs/article/0,,id=210607,00.html, accessed October 20, 2009.
195 :Driving the Solution the Plug-in Hybrid Vehicle ", Electric Power Research Institute, 2005.
196 "Figure 2 - On a Typical Day, How Many Miles One-Way Do You Travel from Home to Work?", Bureau of Transportation Statistics, U.S. Department of Transportation, http://www.bts.gov/publications/omnistats/volume_03_issue_04/html/figure_02.html.

criteria emissions, carbon emissions, greenhouse gas emissions, and the well-to-tank efficiency of the processes used to produce the electricity are taken into account to ensure that net effective emissions per vehicle are an improvement over conventional gasoline vehicles.

Even with several PHEV and BEV models expected to be available in the coming years, the total number of vehicles available nationwide will be low, on the order of 100,000 per year for several years. There is a lot of warranted interest in PHEVs and BEVs, which will likely be significant players in the market, but this is not expected to occur for many years. HEVs were introduced in the U.S. in 2000 and are just now reaching a market penetration of between 2-3% of new vehicle sales. PHEVs and BEVs are a step beyond HEVs in both technology and cost, so the rate of market share capture is expected to be slower than HEVs. Therefore, BEVs/PHEVs are not expected to represent a large portion of near-term new vehicle sales, and so will represent a near-zero portion of the overall vehicle fleet in Maryland (estimated to be 4.77M in 2009).

What Can Be Done to Promote Electric-Drive Vehicles?

Even though widespread PHEV/BEV use is years away, there are several things Maryland could do to promote PHEVs/EVs:

- Mandate that the State purchase PHEVs and BEVs.
- Establish a vehicle sales tax exemption program for the purchase of PHEVs and BEVs.
- Establish HOV, parking, and vehicle registration incentives for PHEVs and BEVs.
- Establish a zero-emission vehicle partnership with a leading electric vehicle manufacturer.

Mandate that the State Purchase PHEVs and BEVs

Maryland should consider mandating that State fleet organizations purchase BEVs or PHEVs for a portion of new vehicle acquisitions. This option is discussed in more detail in the "lead-by-example" Section (6.3.4). A conservative goal (e.g. 1 or 2%) should be set initially to limit the additional cost these vehicles will add to the budget. This could start with a small demonstration fleet to provide more information on cost, utility, and maintenance differences between conventional and electric-drive vehicles, charging infrastructure permitting and installation requirements, and will showcase these vehicles for residents, companies, and local governments.

Establish a Sales Tax Exemption Program for the Purchase of PHEVs and BEVs

The State should consider establishing a time-limited sales tax exemption for the purchase of PHEVs and BEVs. The program would help decrease the vehicle purchase cost, which along with other tax credits (e.g. IRS vehicle credit) would enable more individuals, businesses, and government entities to purchase PHEVs/EVs. Since only a relatively small number of vehicles are anticipated to be sold in Maryland in the next several years, this option should not result in a large fiscal impact.

Establish HOV, Parking, and Vehicle Registration Incentives for PHEVs and BEVs

The State should consider an HOV exemption for BEVs/PHEVs as a method to incentivize the purchase and use of these vehicles in Maryland. Similar State programs were effective for hybrid-electric vehicles when they were in the early commercialization stage to help increase use. Since

there are few areas in Maryland with HOV lanes[197], providing drivers with preferential and free parking at State operated parking lots and parking meters could also be implemented as an additional incentive. Vehicle registration fees could also be waived for BEVs and PHEVs for a limited time period.

Establish a Zero-Emission Vehicle Partnership with a Leading Electric Vehicle Manufacturer

The State should consider forming a partnership with a leading electric vehicle manufacturer, such as the Renault-Nissan Alliance (Nissan in the U.S.). The State would work with the manufacturer or vehicle/infrastructure company to develop plans and policies to promote a charging infrastructure for EVs, as well as to deploy, operate, and maintain a charging network for the vehicles. This type of partnership brings vehicles and experience of a top tier vehicle manufacturer and the support that it can provide.

Nissan has been involved in developing batteries for electric and hybrid-electric vehicles for over 20 years, even though most of these vehicles were prototypes or limited production models. Several cities and states have formed partnerships with Renault-Nissan.[198,199] Another option would be to partner with a company such as Better Place (http://www.betterplace.com/) or ECOtality (http://www.ecotality.com/, http://www.theevproject.com/) that works with EV manufacturers and develops and installs the charging infrastructure.

What has been Maryland's Experience with Respect to Electric Vehicles?

The number of full-speed EVs and PHEVs in use in Maryland is estimated in the order of tens of vehicles. The use of BEVs in Maryland and elsewhere in the country has been primarily limited to low-speed EVs. AltCar.org began operation of the country's first EV car sharing program (similar to ZipCar) in Baltimore using the Indian built Maya 300 low-speed vehicle.[200] The company also will offer the vehicle for sale to individuals, companies, and government entities. The Baltimore City Police Department uses NEVs at the Inner Harbor. Low-speed non-road electric vehicles are common at universities, military bases, and other large self contained campuses where the vehicles are not operated on public roads. It is difficult to determine the number of vehicles since they are not required to be licensed.

What Are Other States' Experiences with Electric-Drive Vehicles?

Several regional groups in California, including cities, air quality management districts, universities, utilities, and national labs, have been testing PHEVs in fleet evaluations since 2004.

New York State, began a two-phase program in 2006 to purchase a demonstration fleet of converted PHEV vehicles (Toyota Prius and Ford Escape).[201,202] The State has been evaluating the initial five

[197] "High Occupancy Vehicle (HOV) Lanes Frequently Asked Questions", Maryland Department of Transportation Website, Accessed August 30, 2009, http://www.sha.maryland.gov/index.aspx?Pageid=249.
[198] Nissan Leaf Electric Car Website, Accessed August 30, 2009, http://www.nissanusa.com/leaf-electric-car/.
[199] Nissan partners include Tennessee; Oregon; Sonoma County, California; Raleigh, North Carolina; San Diego, California; Phoenix, Arizona; Tucson, Arizona, and Seattle, Washington. Nissan Zero Emission Website, http://www.nissan-zeroemission.com/EN/index.html.
[200] Altcar.org Website, Accessed August 20, 2009, http://www.altcar.org/.
[201] "NYS Governor Announces Winners of PHEV Conversions", December 21, 2006, Calcars.org website, http://www.calcars.org/calcars-news/620.html.

vehicles. The ultimate goal of the project is to use the remaining $9 million to retrofit 600 State owned HEVs as PHEVs.

California and Hawaii have signed agreements with Better Place to begin the development and implementation of EVs and the required charging infrastructure. Several countries have signed agreements with Better Place, including Israel, Denmark, and Australia. The Province of Ontario, Canada also signed a similar agreement. The Japanese government is providing funding for Tokyo's largest taxi operator to implement EV taxis with swappable battery packs to enable continual operation.

Several cities and states, including Tennessee, Oregon, Sonoma County (CA),Raleigh (NC), San Diego (CA), Phoenix (AZ), Tucson (AZ), and Seattle (WA) have formed partnerships with Renault-Nissan for participating in the Nissan EV vehicle and infrastructure development and rollout.

In Northern California, the mayors of San Francisco, San Jose, and Oakland have developed policies to develop and expand the infrastructure for EVs, including expediting the permit and installation processes for charging outlets; providing incentives for employers and other organizations who install charging infrastructure at the workplace and other parking facilities; developing standard regulations governing EV infrastructure across the region; and establishing programs to purchase EVs for use by city and state employees. The Mayors will work with other cities in the Bay Area as well as regional government organizations and private sector partners.[203]

The State of Georgia offers tax credits for both zero-emission vehicles (battery-electric vehicles or hydrogen fuel cell vehicles) and for EV chargers. The ZEV credit is for up to 20% of the cost of the vehicle up to $5,000, and the charger credit is for 10% of the charger cost up to $2,500.[204]

How will Promoting Electric-Drive Vehicles Help Achieve Maryland's Goals?

- **Energy Efficiency:** Electric drive vehicles will increase the electricity demand, but will decrease the overall transportation energy demand. Electric drive vehicles also provide flexibility of energy source so the State's transportation energy demand is not linked to one fuel source as it currently is.
- **GHG Reduction:** This option is not expected to result in large measureable reductions in either petroleum use or energy use in the next ten years. Rather, it will result in real-world experience information on the use, maintenance, and charging of PHEVs/BEVs that will be valuable for adopting EVs state-wide. This, in turn, could have a significant impact on GHG emissions in the state. For example, if PHEVs were able to achieve a 10% market penetration over the next decade, the total tailpipe GHG emissions from automobiles in Maryland in 2018 would decrease by 2.97 million tons assuming baseline fuel use growth.

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[202] Transportation Example – Plug-In Hybrid Electric Vehicles", New York State Development Authority website, http://www.nyserda.org/programs/transportation/hybrid.asp.
[203] "Mayors Aim to Make San Francisco Bay Area the Electric Vehicle Capital of the U.S.", Press Release, 11/20/2008, City and County of San Francisco Website, http://www.sfgov.org/site/mayor_index.asp?id=93399.
[204] "Georgia Electric Laws and Incentives", U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, Alternative & Advanced Fuels, http://www.afdc.energy.gov/afdc/progs/ind_state_laws.php/GA/ELEC, accessed October 22, 2009.

- **Green Jobs:** Maryland could use the current or propose an expanded manufacturing base to persuade electric vehicle manufacturers and component suppliers to locate their facilities in the State to create jobs.

The GHG reduction estimate above assumes that these vehicles are charged with non-polluting renewable power such as solar, wind, hydro, or nuclear. It is critical that the fuel usage, criteria emissions, carbon emissions, greenhouse gas emissions, and the well-to-tank efficiency of the processes used to produce the electricity are taken into account to ensure that the net effective emissions per vehicle are an improvement over the conventional gasoline vehicle being replaced. Studies have shown that the net per vehicle emissions for electrically-driven vehicles in areas that have a high percentage of electricity produced by coal, such as Maryland, are similar to, or show only a small improvement in greenhouse gas emissions (GHG). Power generation from natural gas reduces the GHG emissions compared to coal due to the lower carbon content per potential energy output of natural gas. Improvements in power plant generation technology and more efficient new powerplants will decrease the emissions and improve the GHG savings. The ideal solution for eliminating the connection between transportation and carbon emissions is to power electrically-driven transportation using clean renewable power generation (e.g. solar, wind, biomass, etc.).

What are the Advantages and Disadvantages of Promoting Electric-Drive Vehicles?

Advantages include:

- Maryland would evaluate the newest technology with the greatest potential benefit for reducing petroleum use, reducing GHG emissions, and increasing the State's and country's energy independence. The geopolitical ramifications of dramatically reducing oil imports from unstable foreign regimes are difficult to overstate.
- Valuable lessons learned from these experiences would help legislators, technology developers, electric utilities, electric contractors, and the general public better understand all aspects of vehicle technology, vehicle use, vehicle operations and maintenance costs, and charging infrastructure installation/operation/cost.
- Options do not have a significant fiscal impact since the adoption of PHEVs/BEVs is expected to be slow.

Disadvantages include:

- Per vehicle cost will be high, especially when compared to a conventional gasoline vehicle, FFV, or HEV even when production volumes reach mass market levels.
- Driving range of EVs is limited compared to a conventional vehicle, which will have to be considered when selecting a vehicle.
- Limited vehicle availability, including number of models available and sales volume.
- Very high battery costs on the order of $1,000 per kWh for lithium-ion batteries, which can account for $10,000 to $50,000 per vehicle depending on the battery capacity.
- Limited driving range compared to a conventional vehicle (e.g. 100 miles per charge versus 400 miles per tank).
- Long battery recharging times between 4 hours and 12 hours depending on the electricity service (i.e. 110VAC versus 208/220VAC).

6.3.4 Lead-by-Example to "Green" the State Fleet

The State fleet includes a total of 9,045 vehicles: 4,046 sedans, 1,923 pickup trucks, 2,833 vans/SUVs, and 243 other vehicles such as dump trucks.[205] The State fleet represents a very small percentage (less than 0.2%) of the total number of vehicles in the state (4.77 million in 2008).[206] Even though this is the case, the State's fleet operation provides an example to residents, business, and local governments on how best to fuel and use vehicles. Beyond showing leadership, the experience and lessons learned from the State's programs can be shared with others to speed decisions for new vehicles and fuels.

What Can Maryland Do to Green the State Fleet?

The State is already active in several areas of green transportation. However, additional steps can be taken to better understand the fleet's operation, minimize overall fuel use, and maximize the amount of alternative fuel used.

Baseline Fleet Assessment

The first step is to perform a baseline fleet analysis to determine vehicle population, fuel use, emissions profile, use patterns, and geographic vehicle distribution. Following this, a structured implementation plan for fleet improvements should be developed proposing use pattern modifications, available replacement models, and fueling infrastructure.

The U.S. DOE's regulations require that at least 75% of light-duty vehicle acquired be alternative fuel vehicles (AFV). Fuels considered as alternative fuels by the U.S. DOE include: ethanol, methanol, biodiesel, electricity, natural gas, liquefied petroleum gas (i.e. propane), and hydrogen.[207] Hybrid-electric vehicle (HEV) acquisitions, unfortunately do not currently count towards the 75% requirement, although changes to this requirement are under review by DOE. The 75% requirement ensures a high percentage of the State fleet vehicles are AFVs, but the program does not require that alternative fuel is used in these vehicles. Since many of the vehicles are FFVs, they are refueled by regular gasoline most of the time. The result is that other more efficient gasoline vehicles cannot be purchased that could reduce the State's fuel use. These vehicles, including HEVs, can be purchased as part of the remaining 25% of vehicle acquisitions.

State Fleet Vehicle Selection and Use Analysis

A cost-effective method for reducing fuel use is to replace larger passenger vehicles with smaller passenger vehicles where possible. It is likely that most larger passenger vehicles could be replaced by vehicles that are one or two class sizes smaller than the current vehicle. Choosing hybrid-electric vehicles and efficient clean diesel vehicles can also lessen fuel consumption.

In parallel, current State fleet vehicle use could be optimized through improved fleet management practices, such as combining trips and maximizing the number of passengers in all vehicles. For example, scheduled van service between key employee destinations like Baltimore and Annapolis could be established.

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[205] Email communication from Larry Williams, Department of Budget and Management, State of Maryland, August 31, 2009.
[206] "2009 Annual Attainment Report on Transportation System Performance", Maryland Department of Transportation.
[207] Alternative & Advanced Fuels webpage, U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, Alternative Fuels & Advanced Vehicles Data Center, http://www.afdc.energy.gov/afdc/fuels/index.html.

Maximize Alternative Fuel Use for State Fleet Vehicles

Simply purchasing alternative fuel vehicles and making fueling available does not impact the State's petroleum use and GHG emissions. The State should consider developing an enforceable policy or regulation to ensure that the State's alternative fuel vehicles are operated on alternative fuels whenever possible. State staff should be trained to learn about the vehicles and fuels to understand the importance of using alternative fuels in the vehicles and the importance of showing leadership to Maryland consumers. The State should also track E85 use in each State vehicle to determine which E85-capable vehicles are actually using ethanol.

Begin Pilot Integration of Plug-In Hybrid-Electric and Battery-Electric Vehicles into the State Fleet

In order to begin the understanding of and the transition to electric drive vehicles, the State should purchase a test and evaluation fleet of commercially available PHEV and BEVs available from established vehicle manufacturers as they become available. The demonstration program could be used to evaluate the vehicles' petroleum reduction performance, GHG reduction performance, exhaust emission reduction performance, and their ability to meet the needs of the State fleet.

In parallel, the State should install the necessary charging infrastructure for its electric vehicle fleet. The charging infrastructure development will provide the State with valuable lessons on implementation experiences and its affect on Maryland consumers and utilities.

As with AFVs, electric vehicles will show the public that the State is proactive in learning about and implementing available technologies. The State could use these vehicles as an outreach tool through public workshops or ride-and-drive opportunities for the State's residents to learn about and experience these vehicles firsthand. The momentum for electrically-driven vehicles is gaining public support, and this type of outreach would enable a cost-effective grassroots method for disseminating information and gauging public opinion.

What is Maryland's Experience with Greening the State Fleet?

As of 2009 the State fleet includes 1,563 light-duty alternative fuel vehicles (1,419 FFVs, 144 compressed natural gas vehicles) and 63 light-duty hybrid-electric vehicles. Two hundred FFVs and 30 hybrid-electric vehicles are projected to be added to the fleet in 2010 and in 2011. E85 and biodiesel blends are the most heavily supported alternative fuels in terms of vehicle availability, fuel availability, and public and governmental support. Maryland has set a goal of using B5 for 50% of the State fleet diesel vehicle fuel use. In addition, the Maryland Transit Administration operates 10 diesel hybrid-electric buses that reduce fuel use by approximately 23% compared to conventional buses. The entire fleet will be transitioned to hybrid-electric buses over the next decade. The fleet also uses a 5% biodiesel blend (B5) to further reduce petroleum use.[208]

The State, along with private parties, is developing petroleum reduction goals. The goals are being considered not only to stabilize costs, but also to decrease energy dependence on neighboring states and foreign countries. The State's actions should be documented and portrayed as a model for local governments, communities, and individuals to follow.

[208] MTA Green Facts website, Maryland Transit Administration, http://www.mtagogreen.com/mtagreen.html.

What Are Other States' Experiences with Greening Their Fleets?

A number of state fleets across the nation have large alternative fuel vehicle programs that are very visible to their communities. New York State began a two-phase program in 2006 to purchase a demonstration fleet of converted PHEV vehicles (Toyota Prius and Ford Escape).[209,210] The State has been evaluating the initial five vehicles. The ultimate goal of the project is to use the remaining $9 million to retrofit 600 State owned HEVs as PHEVs.

New York City is conducting a BEV test program including of 10 BMW Group's Mini-E BEVs that will be used as inspectors from the Mayor's Office of Operations to drive every city street once per month and report conditions that negatively impact quality of life.[211]

In 2003 California conducted an assessment of the State fleet to determine the baseline fuel use and to evaluate and determine options for reducing the fuel use by 10%.[212] The main recommendation was to use alternative fuels in existing alternative fuel vehicles. In this case the vehicles were dual-fuel natural gas and propane vehicles, but were being operated primarily on gasoline. It was also suggested to require that either hybrid-electric vehicles or the most fuel efficient vehicles in a given class be purchased for new fleet purchases. This option is limited because federal regulations regarding State fleet purchases of AFVs exclude hybrid-electric vehicles. Other very effective measures suggested were several fleet management practices that more effectively use vehicles by combining trips, making fewer trips, and maximizing the number of passengers in all vehicles. The combined estimated fuel savings for these programs was between 10 and 14%.

In Washington State, effective June 1, 2015, all state and local government agencies will be required to use 100% biofuels or electricity to operate all publicly owned vehicles.[213] To phase in this requirement, all state agencies must achieve 40% biofuel or electricity use by June 1, 2013.

How will Greening the State Fleet Help Achieve Maryland's Goals?

- **GHG Reduction:** This option will not necessarily have a significant measurable effect on total petroleum consumption or greenhouse gas emissions in Maryland. It can, however, provide necessary support for refueling stations to reduce fuel costs and build markets for the fuels, and can provide an example to State residents for using alternative fuels. Valuable lessons on both advanced alternative fuel and electric vehicle technology and refueling/charging infrastructure installation and operation can be learned by being an early adopter of these technologies.

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209 "NYS Governor Announces Winners of PHEV Conversions", December 21, 2006, Calcars.org website, http://www.calcars.org/calcars-news/620.html.

210 "Transportation Example – Plug-In Hybrid Electric Vehicles", New York State Development Authority website, http://www.nyserda.org/programs/transportation/hybrid.asp.

211 "Mayor Bloomberg Announces Progress in City's Efforts to Reduce Emissions through use of Electric Cars and Other Alternative Fuel Vehicles", News from the Blue Room, August 24, 2009, http://www.nyc.gov/portal/site/nycgov/menuitem.c0935b9a57bb4ef3daf2f1c701c789a0/index.jsp?pageID=mayor_press_release&catID=1194&doc_name=http%3A%2F%2Fwww.nyc.gov%2Fhtml%2Fom%2Fhtml%2F2009b%2Fpr385-09.html&cc=unused1978&rc=1194&ndi=1

212 "California State Vehicle Fleet Fuel Efficiency Report: Volume II", TIAX, LLC, Report # 600-03-004, April 2003, http://www.energy.ca.gov/reports/2003-05-12_600-03-004-VOL2.PDF.

213 "Washington State Fleet Alternative Fuel Use Requirement", Washington State House Bill 1481, 2009, and Revised Code of Washington 43.19.647 and 43.19.648, http://www.leg.wa.gov/legislature/Pages/visitingthelegislature.aspx and http://apps.leg.wa.gov/rcw/.

What are the Advantages and Disadvantages of Leading by Example to Green the State Fleet?

Advantages include:

- Maryland has the opportunity to evaluate the newest technology with the greatest potential benefit for reducing petroleum use, reducing GHG emissions, and increasing the State's energy independence.
- Learn valuable lessons on vehicle technology and the charging infrastructure installation and operation.
- Helps bolster commercial stations throughput to ensure the stations are viable and profitable.
- State fleet can support the expansion of E85 fueling infrastructure and raise fuel volumes to reduce fuel cost.

Disadvantages include:

- Limited refueling infrastructure may make it impractical for many State employees to purchase E85 for FFVs.
- If E85 cost is not low enough, cost per mile traveled will be higher than for conventional gasoline.
- Per vehicle cost of electric vehicles will be high, especially when compared to a conventional gasoline vehicle.
- Driving range of EVs is limited compared to a conventional vehicle, which will have to be considered when selecting a vehicle.

6.3.5 Increase Support for Commuter Connections Program

What is the Commuter Connections Program?

The Metropolitan Washington Council of Governments (MWCOG), the Baltimore Metropolitan Council (BMC), and the Maryland Department of Transportation have operated commuting programs under the Commuter Connections program designed to educate the public (both employers and employees) on various ways to decrease the number of vehicles on the road, and thus decrease fuel use and exhaust emissions. The MWCOG Commuter Connections (http://www.commuterconnections.com and http://www.commuterconnections.org) and BMC programs cover different parts of Maryland, and in some cases overlap. The combined coverage area includes 86% of the State population and likely a larger percentage of the congestion. Maryland currently funds MWCOG's Commuter Connections program with $2.45M (roughly 47% of total program funding); Virginia and the District of Columbia also contribute funds to the program.

It is critically important to provide transportation alternatives and innovative land-use patterns for a broader section of Maryland's residents and businesses. Addressing these issues could significantly decrease fuel demand, time spent in traffic, air quality concerns from vehicle exhaust emissions, climate change issues caused by vehicular GHG emissions, and vehicular traffic congestion associated with commuting.

The Commuter Connections program advocates for numerous commuting options including: teleworking, mass transit use, rideshare/carpool/vanpool, alternative work schedules (e.g. four ten-

hour days instead of five eight-hour days), bike to work, walk to work, etc. Eliminating vehicle trips, decreasing the number of trips, or increasing the number of people per vehicle can have a meaningful impact on fuel demand and traffic congestion. In addition, use of these program options would lower fuel and vehicle maintenance costs. Teleworking is becoming a more popular option and can be a formal or informal arrangement between employers and employees, increasingly allowing work to be done from home or a telework center.

What Can Be Done to Further Promote the Commuter Connections Program?

The program has developed information about a complete portfolio of commuting options and outreach tools for individuals and for businesses. The program does not provide financial incentives for participating. Reduced vehicle operating costs and commute-related stress are notable benefits for participants. Program outreach is accomplished through in-person workshops, the Commuter Connections website, call center, information booths at community events, and advertising (online, radio, and television). The program activity level is limited by the available personnel resources and outreach funding. The State should consider providing additional funding to the Commuter Connections program to expand its reach to engage more individuals and companies, and should consider expanding the Guaranteed Ride Home program to the Baltimore metropolitan region.

What has been Maryland's Experience with the Commuter Connections Program?

MWCOG does extensive tracking of program effectiveness, a model that has been studied and replicated in other major metropolitan areas around the country. As a result of the portfolio nature of the program, the cost-effectiveness of each sub-program cannot be accurately evaluated. Cumulative program benefits can be used as a surrogate for detailed information on the sub-programs. MWCOG claims an overall cost-effectiveness of $0.01/vehicle mile travelled (VMT), $0.25/ gasoline gallons equivalent saved (assuming $2.50 per gallon of gasoline) and $15/ton of GHG reduced. Thus, the program has good cost-effectiveness and petroleum savings. However, due to the magnitude of gasoline use in the state (roughly 3 billion gallons per year), the savings on an overall percentage basis are small.

What Are Other States' Experiences with Commuting Programs?

The Association for Commuter Transportation and the Transportation Demand Management Institute (TDMI) operate the CommuterChoice (http://www.commuterchoice.com/index.php) service with funding from the U.S. Environmental Protection Agency, U.S. Department of Transportation, and TDMI. The company works with employers in most of the country's major cities (New York City, Los Angeles, Washington D.C., Atlanta, Boston, etc.), connects with local organizations to help them learn about and implement commuting options programs for their employees such as carpool/vanpool/ridesharing, location of park and ride lots, mass transit (bus and rail), guaranteed ride home, and bicycle to work.

There are several other commuter programs in large cities across the United States that are similar to Commuter Connections. Many provide the same services. Selected programs from across the country and highlights of unique services provided include:

- **MetroPool (greater New York City region including New York and Connecticut) NuRide** – MetroPool is an incentive-based ride network that gives riders NuRide Miles Reward Points that can be redeemed for reward.[214]
- **Metro STAR (greater Houston-Galveston area) Ride Matching** – Metro STAR is a free online database that helps riders find existing car/vanpools or start new ones (both STAR and privately operated).[215]
- **511 (San Francisco Bay area) My 511 Traffic Page** – 511 allows online users to create custom traffic pages that are tailored to their commute. Among other features, users can receive customized alerts and access their page from the web or cell phones. [216]
- **RideSmart (greater Atlanta area) SchoolPool** – RideSmart SchooPool is a pilot program providing carpooling services to parents that are driving their children to a common school.[217]
- **CommuteSmart (Southern California)** – Provides information and training workshops for employers who are interested in setting up programs in their companies.[218]

How will Increasing Support for Commuter Connections Program Services Help Achieve Maryland's Goals?

- **GHG Reduction:** Traffic congestion, vehicle population, vehicle miles travelled, fuel use, and GHG will not improve until the number of vehicles on roadways is reduced. Commuting methods are impacted by economics and convenience, and cannot be mandated. Recent high fuel prices have showed that there is a tipping point at which personal behavior is impacted. Unfortunately, increasing fuel prices or fuel taxes to remain above the tipping point are not popular. Therefore, education programs such as those provided by the Commuter Connections increase the knowledge and adoption of options to reduce commuting.

What are the Advantages and Disadvantages of Providing Additional Support for the Commuter Connections Program?

Advantages include:

- The Commuter Connections program has shown continual improvement as additional programs have been added and as commuters have become more interested in finding commuting alternatives.
- Program is a cost effective measure to reduce VMT and GHG emissions.
- The current funding level is relatively low for the severity of the problem being addressed. Increasing funding will not represent a significant increase to the annual State budget.
- Increased worker productivity leads to higher revenues and higher tax revenues.

Disadvantages include:

- Program results have been able to just keep up with population increases.
- Total VMT and GHG reduction results are relatively small.

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[214] MetroPool Website, http://www.metropool.com/index.shtml.
[215] Metropolitan Transit Authority of Harris County, Houston, Texas, http://www.ridemetro.org/Services/StarVanPool.aspx.
[216] 511.org website, http://www.511.org.
[217] Ride Smart website, https://www.myridesmart.com/html/index.htm.
[218] CommuteSmart website, http://www.commutesmart.info.

6.4 Recommendations

Appendix A. Maryland Energy Outlook Advisory Committee

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